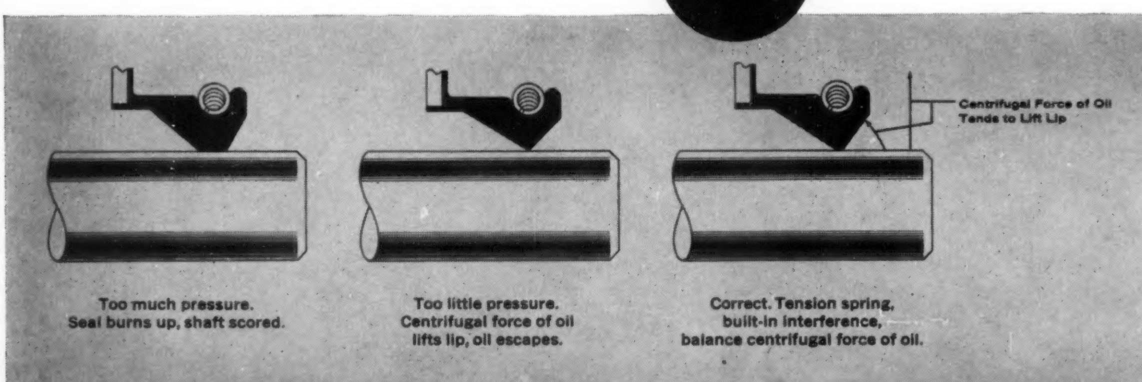
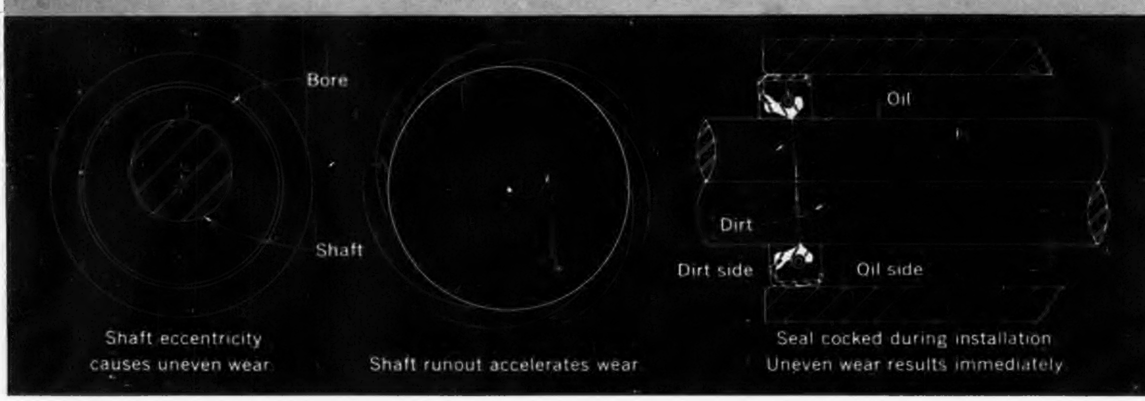
MAY 1961

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

Lip pressure...too much or too little, and you've a leaker for sure!





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Agricultural Engineering

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CONTENTS · **MAY, 1961** · **Vol. 42, No. 5**

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ASAE Film Wins Blue Ribbon

"AGRICULTURAL Engineering — The Profession with a Future," the ASAE career motion picture, has been awarded first prize in one of the 33 categories judged in the Third American Film Festival sponsored by the Educational Film Library Association.

The award, a medal and blue ribbon frozen in lucite, was presented at the closing banquet in New York, April 21, to Sid L. Schwartz, chief of the Research and Planning Section, for the Motion Picture Service of the U.S. Department of Agriculture, which supervised production of the film. The ASAE film was one of the 250 non-theatrical short subjects which had been screened from more than 3000 entries, in winning the honor of being shown at the festival. It won top prize in the "Guidance — Personal and Vocational" category.

Acceptance of the award cannot be complete without acknowledging the efforts of those who helped make the motion picture possible. In addition to ASAE members who served on various committees and together with interested industries and agricultural engineering departments more than met the financial requirements, it is most appropriate to extend special appreciation to the USDA Motion Picture Service and to a USDA agency committee consisting of representatives of the Federal Extension Service, Agricultural Research Service, Soil Conservation Service, Rural Electrification Administration, Agricultural Marketing Service, and Farmers Home Administration, which met with the ASAE Motion Picture Production Committee in the early days of the project to make arrangements for the Office of Information to take on the job of preparing the script and arranging for production. Also, special credit has been earned by Motion Picture Service script writer Bertrand Channon, who was assigned to work with technical advisors L. W. Hurlbut, University of Nebraska; E. G. McKibben, ARS; W. M. Carleton, ARS; H. S. Pringle, FES; Archie Stone, International Harvester Co.; and E. T. Swink, Virginia Polytechnic Institute; and to MPS photographer, Robert Keifer; librarian, Mrs. Anne Ware; film editor, William Riggs; and many other technicians who brought the film into being. With the help of industry for hard-to-get scenes, the important story of the ag engineer could finally be told.

Significant in addition to the recognition during the festival is the fact that the blue ribbon winners go on circuit by EFLA and are available to any organization or community as "Blue Ribbon" films upon request between May 1 and September 1. It should go without saying that this new recognition of the ASAE motion picture as a top-quality film should encourage all ASAE members to increase their effort in promoting the use of a most effective career guide.

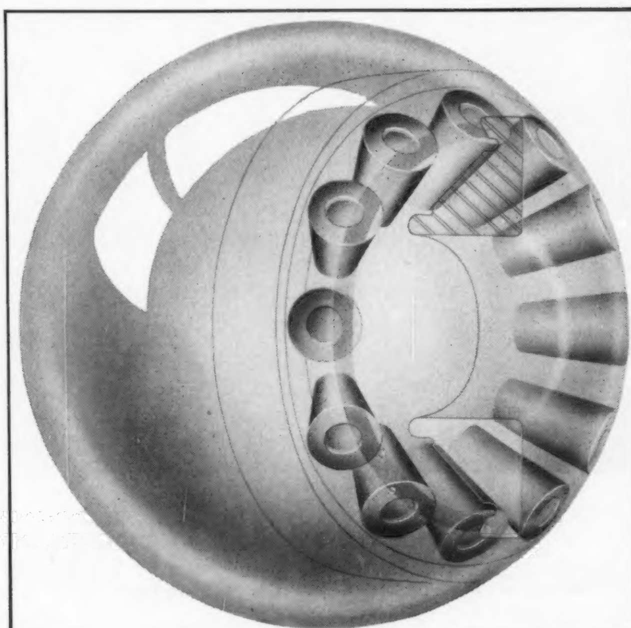
AE Exposition Progress

SHEA Expositions Corp., AE Exposition managers for the Winter Meeting to be held December 12 to 14, in the Palmer House in Chicago, have reported that first requests for exhibit space have been received. Manufacturers who made fast application for exhibit booths have products ranging from farm structures to chain belts, and from automotive parts to pillow blocks. The Shea organization states that the response is encouraging and such positive interest exhibited to date endorses the belief that there will be a crowded exhibit hall for the first ASAE-endorsed exhibit.

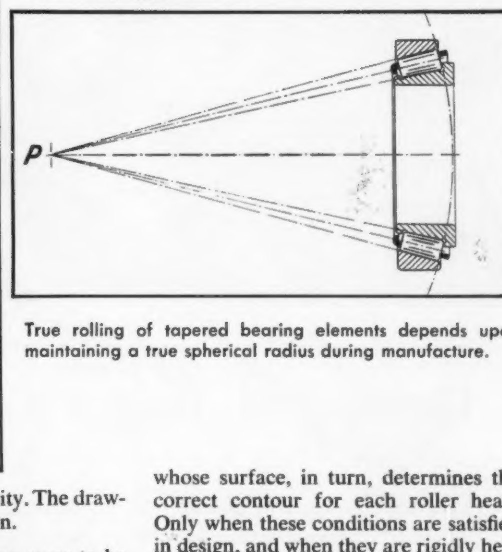
One in a series of technical reports by Bower

BEARING BRIEFINGS

SPHERICITY—ESSENTIAL TO MAXIMUM BEARING PERFORMANCE



When you require bearings, we suggest you consider the advantages of Bower bearings. Where product design calls for tapered or cylindrical roller bearings or journal roller assemblies, Bower can provide them in a full range of types and sizes. Bower engineers are always available, should you desire assistance or advice on bearing applications.



True rolling of tapered bearing elements depends upon maintaining a true spherical radius during manufacture.

For a tapered roller bearing to achieve maximum performance, i.e., maximum life and capacity under load, it must have true sphericity — a condition of bearing geometry which permits true rolling of the tapered rollers in the raceway.

True rolling in tapered bearing elements is the result of maintaining a critical geometric relationship between the raceways and the contact surfaces of each roller. True rolling is essential to maximum performance. Without it, premature bearing failure is certain.

As engineers know, a tapered roller will describe a true circle when rolled on a plane surface. *It will always roll in this one path precisely, without sliding or skewing.* But to put true rolling to work in a bearing which can carry both heavy thrust and radial loads, it is essential that the rollers *and* the raceway have a true spherical radius, or sphericity. The drawing illustrates this condition.

If each roller in the bearing were to be extended in length, while retaining its taper, it would form a cone, terminating at point "P". All cones generated from all rollers would meet at point "P", which is also the center of the hypothetical sphere shown. The surface of the sphere would *touch all points on each roller's head!*

In effect, then, each roller's taper determines the radius of a hypothetical sphere whose surface, in turn, determines the correct contour for each roller head. Only when these conditions are satisfied in design, and when they are rigidly held during manufacture, will true rolling take place. In the manufacture of each Bower tapered roller bearing, sphericity is held within extremely narrow limits by means of special Bower-designed precision grinders. The consistent accuracy possible with these machines is one major reason why Bower roller bearings provide maximum performance under all speeds and loads up to the bearing's maximum rating.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION — FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICHIGAN

TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

Report to Readers . . .

ASPHALT SPRAY SPEEDS GERMINATION OF SEEDS An Arizona AES agricultural engineer and an industry chemical engineer report promising results from the use of asphalt to hasten the germination of seed and get seedlings off to a good start. A very thin asphalt is used for the purpose, and this is mixed with a chemical spreader to ensure even coverage. The preparation is sprayed from the nozzles of a tractor-propelled spray rig that travels at a fairly rapid speed. . . . . The spray is non-toxic to plants and there is little trace of it left after the first cultivation. Its only effect is to raise the temperature of the soil a few degrees and thereby provide extra warmth to hasten germination of the seed. The researchers believe it is possible that the extra warmth will tend to suppress certain fungi that thrive in a cold soil. . . . . Continuation of this study during the current year will be devoted to determining whether earlier seedling emergence will make any material difference in crop yields. In fact, the researchers hope to prove two things from this study, namely, whether the practice will contribute to increasing world food supplies and at the same time open up a large market for the asphalt residue from petroleum refineries.

NEW VARIETY OF SESAME MAKES MACHINE HARVESTING POSSIBLE The major bottleneck to economic production of sesame in the United States appears about to be broken. With the finding in Venezuela by a USDA plant geneticist of a lone sesame plant having exceptionally tough pods, South Carolina AES horticulturists have since been engaged in extensive breeding work. This has resulted in the development of a tall, straight-growing plant with tough pods that do not easily shatter. . . . . The development of this variety of sesame, say the researchers, means that the crop can be harvested entirely by machine, which will remove the main obstacle of its economic production in this country. . . . . The oil from sesame is used in shortenings, soaps, and other products, and after the oil is extracted, the seed makes a high protein feed for livestock. There is also under laboratory development a product from sesame oil that is claimed will boost the lethal power of pyrethrum insecticides many times.

LARGER FARMS AND LARGER-CAPACITY TOOLS CAN BE THE KEY TO HIGHER FARM RETURNS Iowa SU agricultural economists say their studies show that the trend toward fewer and larger farms is likely to result in better management and farm practices. In a four-county area of the state, it was found that the "consolidated" farm averaged 300 acres. . . . . Farmers who gave up off-farm work and employed family labor more fully, found they could handle the larger farms as efficiently as the smaller ones, without adding much more machinery and labor. . . . . While use of larger-capacity equipment and power units increased the machinery investment, it substantially decreased the hand-labor requirement.

RECIRCULATING USED DRYING AIR INCREASES HAY DRIER EFFICIENCY Rutgers U agricultural engineers say that efficiency in wagon drying of baled hay can be greatly increased if some of the used drying air is recirculated through the drier. Flat-bottomed wagons loaded with baled hay of 45 percent moisture or less are placed under drying ducts in a drive-through building. The drier forces the heated air down through the hay and exhausts it to the outside. After the hay is about half dried, 75 percent of the used air is then recirculated through the drier, and the other 25 percent is discharged outside the building and replaced by fresh air. . . . . With this system and good weather, the hay can ordinarily be cut and crushed in the early morning, raked in the forenoon, dried during the night, and stored the following morning.

(Continued on page 224)

SELECTIVE ASPARAGUS HARVESTER BEING READIED FOR EARLY TESTS

A Michigan AES agricultural engineering and horticultural research team is conducting intensive field tests this season of an experimental asparagus snapping machine. The vital part of the machine is the selective snapping mechanism which selects only asparagus spears that are 5 inches or taller. . . . . The harvester has 33 to 50 snapping units, each 30 inches long and attached at either end to steel chains. Each unit is made of two thin steel rods set from 2½ to 3½ inches apart. The lower rod presses against spears enclosed in the area between the two rods, roughly near the breaking point of the spears. The top rod in rotating presses only against the tops of spears 5 inches or taller. The action of the two rods, pressing in opposite directions, snaps the spears. . . . . When snapped off the spears are gripped between the top rod and a sponge rubber bar and carried up the rear to the top of the machine, where the rotation of the snapping unit is reversed, releasing the spears which then drop into a box.

RESEARCHERS DEVELOP MECHANIZED HOG GROWING-FINISHING PRODUCTION UNIT

An Iowa SU agricultural engineering and swine nutritionist research team recently held the first public showing of a new growing-finishing swine experimental unit they have developed. The structure is equipped for automatic feed handling, grinding and mixing, for automatic cleaning and feeding, and for controlled temperature. . . . . All-metal construction is used throughout, including storage elevators and feed-mixing complex. Radiant heating pipe is built into the concrete floor and includes a separate control for each pen. The housing unit is 50 by 120 feet, and the adjoining building for feed mixing and weighing equipment is 15 by 20 feet. The main building is designed to handle 500 to 600 pigs in confinement until they reach market weight at about 220 pounds. . . . . Wire gates and panels are used to form partitions in the house to facilitate air circulation. The metal feeders used are served automatically by a modified poultry chain-type feed dispenser and are lighted by overhead electric lamps.

AQUATIC WEED KILLER DESTROYS WIDE VARIETY OF POND WEEDS

Soon to become commercially available is a new contact-action herbicide for ridding farm ponds of water-weed infestations and algae. The new product is said to be effective against a wide variety of aquatic weeds at recommended doses far below concentrations harmful to fish and fish food organisms. . . . . This weed killer was developed in close cooperation with government and private research laboratories over several years. It destroys underwater and floating weeds by fast, contact action, as compared with some herbicides that kill by slow, hormonal action. . . . . In addition to its effectiveness and speed in clearing farm ponds of weeds, this new weed killer also has the advantages of ease of application, quick action, safety, and short residual life. Water from a treated pond may be used for irrigation, spraying, or domestic purposes after a short period.

EFFECT OF WHEEL BALLAST ON STABILITY OF FARM TRACTORS

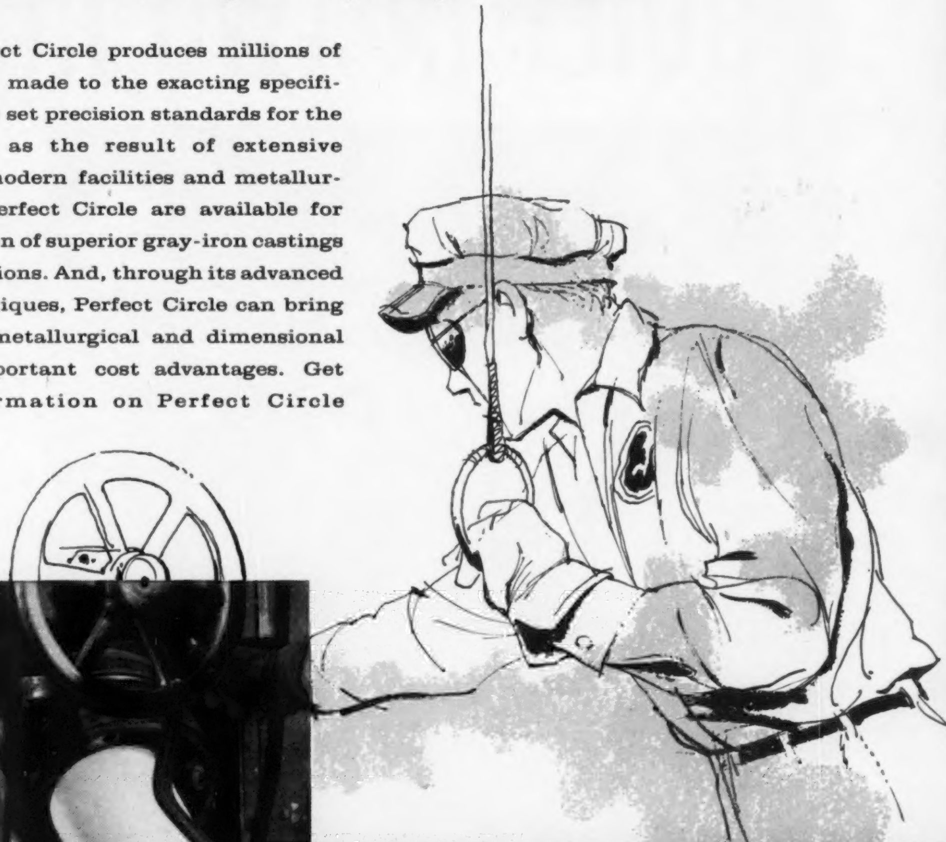
Michigan SU agricultural engineers report results of a study, in which a plastic model of a 12x38 farm tractor pneumatic tire was built and used to study the behavior of fluid in the tire at various rotational speeds. The tests conducted were with fills of 50 and 75 percent calcium chloride and with a 75 percent fill of SAE 20 motor oil. For another series of tests, dry ballast was used. . . . . At 155 rpm (approximately 27 mph tire travel), with a 75 percent calcium chloride fill, forces of 2 to 4 pounds upwards and 2 to 8 pounds downward were exerted by the fluid. According to the dimensional analysis, these forces represent about 1,000 pounds upward and 1,500 pounds downward in an actual tire. It was found that, when used as recommended, dry ballast exerted little or no force on the model.

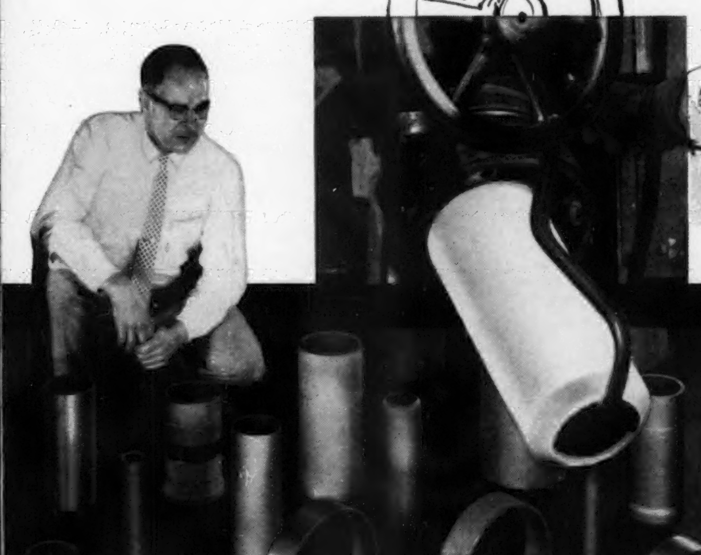
FROM AMERICA'S LEADING PRODUCER OF PISTON RINGS...

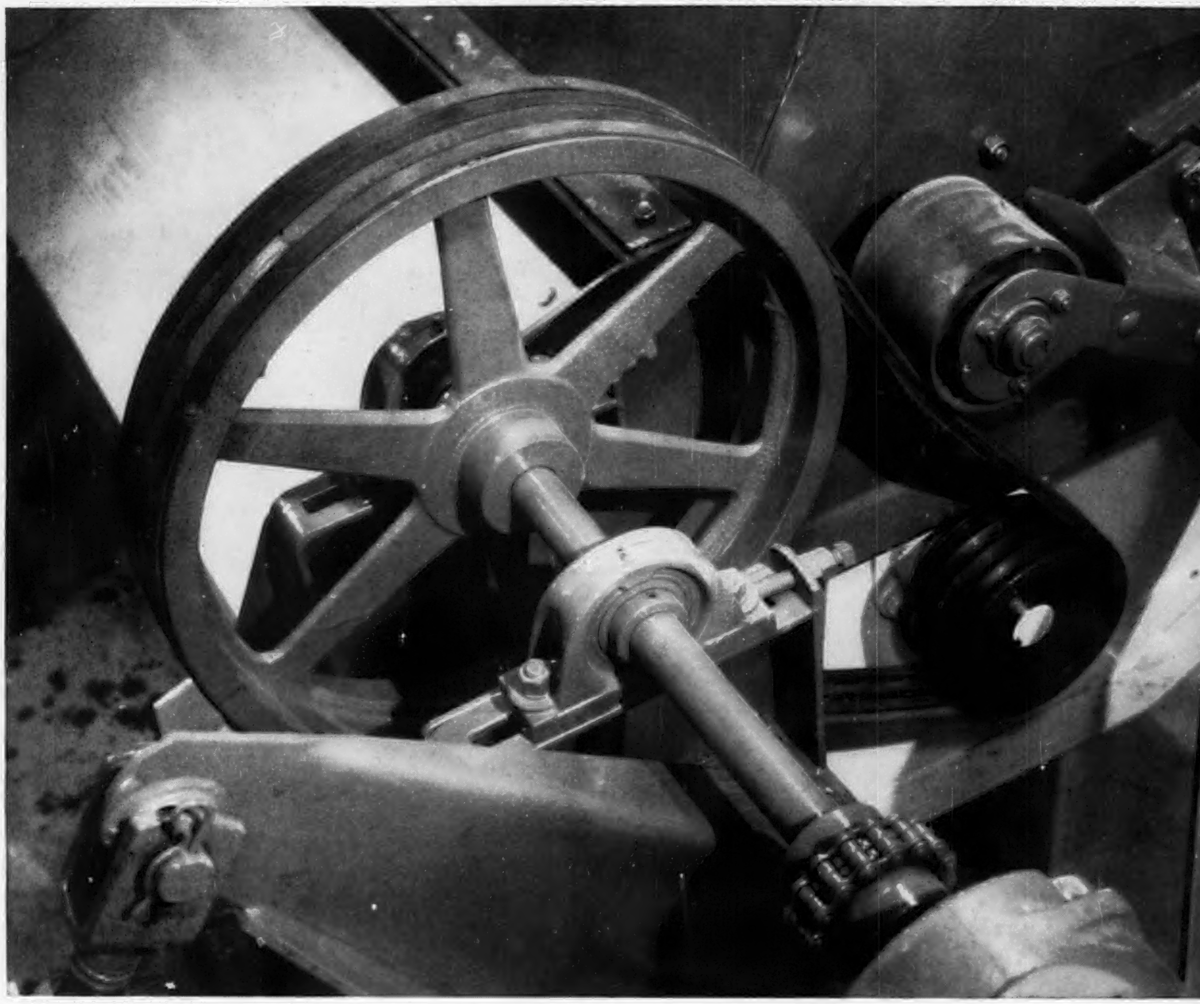
PERFECT CIRCLE PRECISION CASTINGS

STACK-MOLD CASTING

Molds of carefully-controlled green sand are made from the pattern plate, and stacked for pouring. In the example shown at right after shake-out, the castings are 6-up in a stack 20 molds deep. Typical castings produced by this Perfect Circle process include piston rings, thrust plates, valve lifter facings and piston groove inserts.





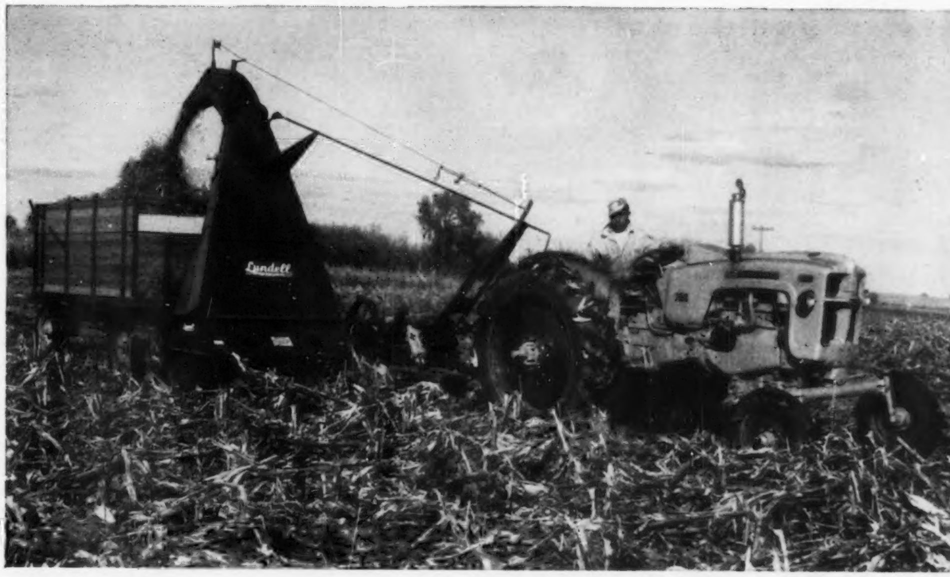


"Four Dayton Die-Cut V-Belts Out Perform 6 Standard Belts"

"Belt slippage and failure constantly plagued us when we used conventional V-belts on the pilot model of our Super 60 Forage Chopper," says Mr. Vernon Lundell, Pres., Lundell Mfg. Co., Cherokee, Iowa. "We faced the possibility of having to redesign the drive from a 4 Belt to a 6 Belt unit to get the power we needed."

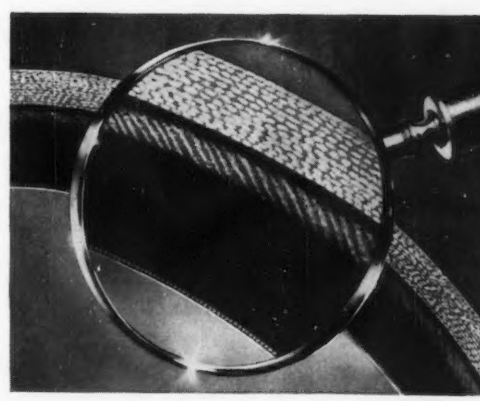
"Our engineers consulted the Dayton representative who recommended a *Dayton Die-Cut, Agricultural V-Belt.* It was the perfect answer. The Dayton Belt easily transmits up to 40% more horsepower than any other belt we have ever tested. Its high coefficient of friction (due to Dayton's exclusive Die-Cut construction) eliminated slippage completely . . . thus solving once and for all the friction and heat conditions which materially reduce the work-life of any V-Belt."

"Exhaustive testing by our engineers has proven that four Dayton Die-Cut V-Belts will actually out-perform a drive system using six conventional V-Belts. That is why we use Dayton V-Belts exclusively and highly recommend them for production line replacement and quick substitutes in the field."



The Lundell Super 60 Forage Chopper performs a wide variety of jobs including hay pick-up from windrow; cutting broadcast cane, alfalfa and brome; grinding corn, etc. This versatility is accomplished by means of quick change cylinders with various sizes of driven sheaves to control speed of operation. As a result the Belts have to handle many different loads and a wide range of speeds.

In the nine years since Lundell Mfg. Co. started using Dayton Die-Cut Agricultural V-Belts not a single one has ever broken, according to Mr. Lundell. "We know of no other V-Belt that can even begin to match this outstanding performance", adds Mr. Filmore L. Ohlson, Lundell Purchasing Manager (shown here left).



The Dayton Die-Cut Agricultural V-Belt has no cover to wear out . . . is specially compounded to continually renew its gripping surface as it operates (whereas conventional fabric-covered belts on this type drive wear smooth and slip). Abrasive materials . . . chaff, mud, chips, stone and metal particles . . . which tear covers and ruin other belts . . . have no such effect on the Dayton Die-Cut Agricultural V-Belt, and can actually **add** to its gripping strength.

Dayton manufactures a complete line of V-Belts for all types of agricultural drives. For assistance with your standard or special V-Belt drives call your nearest Dayton representative or write to:

Dayco CORPORATION

Dayton Industrial Products Co. Div. Melrose Park, Illinois

Agricultural Engineering

May 1961
Number 5
Volume 42

James Basselman, *Editor*

ASAE WINTER MEETING COUNCIL ACTION

IN ORDER that the general membership might have a better understanding of the discussions and deliberations carried on in their behalf by their elected representatives, following is a thumbnail sketch or resume of pertinent Council actions during the Council sessions held before and during the Winter Meeting in Memphis, December 4 through 7, 1960:

President L. W. Hurlbut, in his opening remarks, commented briefly on his travel and experiences to date as president of the Society. He then stated that he felt, in view of the volume of business being transacted at each meeting by the Council, that it was time for Council to consider making procedural adjustments for handling its business. Specifically, he stated that much of the work of the Council could be done more effectively through subcommittees within Council. He also commented that there should be more special and standing committees, such as the Society's Finance Committee, to utilize special talents of members to render needed services. Areas in which such special committees or Council subcommittees might be immediately useful are publications, and borderline membership situations.

The ASAE headquarters report by staff members dealt at length with publications, finances, public relations, advertising, and a report entitled "Program for Progress," which reviewed the Society's professional progress and looked forward to the future development of the Society. The report featuring items which would become necessary for continued efficient function of the headquarters office to accommodate projected growth in the next 10 years, covered such things as additional staff personnel, additional sources of income and additional office equipment.

H. H. Nuernberger, the Society's representative to Engineers Joint Council, reported on recent EJC developments and S. M. Henderson, who represented the Society at the west coast meeting of the National Council of State Boards of Engineering Examiners, reported that one of the major considerations of the meeting was the new model registration law for engineers.

L. H. Skromme reported on his visit with officials of the International Commission of Agricultural Engineering (Commission International du Genie Rural "CIGR") in Paris and recommended that ASAE join CIGR. A report on Sectional reorganization was heard and a tentative report is expected at the June 1961 meeting, and a final report by the December 1961 meeting. Eleven ASAE members were elected to life membership. A question came up concerning the number of honorary members who might be elected within a given period. It was recommended that a list of life fellows be carried in the AGRICULTURAL ENGINEERS YEARBOOK. Approval of a change in Section name and territory of the Washington, D. C.–Maryland Section was authorized.

Following consideration of a Virginia Section resolution, it was voted to add a statement on the ASAE membership application form indicating that reinstatement fee would be waived in the case of members who resign in good standing. Establishment of a Committee on International Relations as a coordinating group for the Society's International affairs was approved. Discussion on the increasing enrollment of students in mechanized agriculture resulted in a recommendation that the Forward Planning Committee consider the mechanized agriculture situation as it might affect or influence the Society in the near future and that the Education and Research Division concern itself with problems relating to curriculums in mechanized agriculture.

Following a report from a subcommittee of the Council, a procedure for borderline membership cases; and appointment of Ralph Hay as honorary ASAE vice-president for the purpose of attending the International Technical Congress of Agricultural Machinery meeting in Paris were approved. Consideration of engineering employment practices was referred to the Council subcommittee of vice-presidents with the request that a report be available for Council consideration at the June meeting.

Following a report from a Council subcommittee on its recommendations concerning commercial exhibits for the ASAE 1961 Winter Meeting, it was voted that the Society should sponsor an exhibits activity beginning with the 1961 Winter Meeting and that a committee be appointed immediately to work out the details and to serve as technical and policy advisors to Shea Expositions Corporation, managers for the exposition.

Policies for accepting contributions and bequests, and income from foundations, were other items covered. Karl H. Norris, ASAE representative to the Policy Committee, Professional Agricultural Societies, reported on a recent Scientific Manpower Commission meeting. He reported that the Dictionary of Occupational Titles, published by the U.S. Department of Labor, is under revision, and SMC (of which the Policy Committee is a member — and ASAE is a member of the Policy Committee) is seeking to get a more appropriate listing of the various branches of engineering and other specialties.

Considerable discussion was given to the "Program for Progress" report given by J. L. Butt, as part of the headquarters report. In response the Council established a tentative time table based on projected Society income. As part of an over-all plan to help meet the financial requirements connected with anticipated growth of the Society, the Council approved a one-dollar increase in the ASAE Winter Meeting registration fee, to become effective with the 1961 Winter Meeting.

Approval was given to selections for McCormick and Deere gold medals and MBMA award by the respective awards juries. Further action resulted in an endorsement of the revised model law, as adopted by NCSBEE on August 18, 1960. ASAE affiliation with the National Academy of Science-National Research Council was discussed and President Hurlbut was requested to look into the possibility of appointment of an agricultural engineer to the board as a member-at-large of the Division of Engineering and Industrial Research, NAS-NRC. A proposal to increase ASAE participation in National Fire Protection Association by increasing its grade of membership was passed. A recommendation was made that the Society's representatives in NFPA be urged to make an effort to take some constructive action concerning a crop drier code.

(Continued on page 257)

Fig. 1 Instrumentation of the test tractor

Tractor Engine Loading

Results of study of engine power and speed requirements for 19 farm operations help engineers match tractor design with job

C. J. Ricketts and **J. A. Weber**
Assoc. Member ASAE *Member ASAE*

THE cost of operating a farm tractor is affected by how well the design of the tractor fits the functional requirements. Because of the wide diversity in the use of farm tractors and the difficulties associated with obtaining good field records, there is little specific information on the actual use of tractors by farmers. However, to attack carburetor redesign (1)* or derive a new bearing-selection formula (2), it is necessary to have a good knowledge of actual tractor use. This paper presents information obtained in a study of tractor use that may be helpful to the engineer in fitting tractor design to the job to be done.

This study, sponsored by the Illinois Farm Supply Company as part of a research project on improvement of tractor maintenance, was divided into two parts: *(a)* use of a single test tractor to study engine horsepower output for farm operations and *(b)* summary of records kept by farmers on the use of 25 tractors for one year.

Instrumentation of Test Tractor

An AC D-17 tractor, loaned by the Allis-Chalmers Mfg. Co., was instrumented so that continuous recordings could be made of *(a)* engine speed, *(b)* manifold vacuum, and *(c)* throttle plate position. Engine speed was obtained by attaching the tachometer cable to a small direct-current generator and recording the voltage output. Manifold vacuum was sensed by a pressure transducer that contained strain gages mounted on an 0.008-in. steel diaphragm. The position of the throttle plate was determined by a linear variable-differential transformer. The signals from the pressure transducer and the differential transformer were recorded on an oscillograph. Since manifold vacuum and throttle plate position are directly related, these two traces could be checked against each other. The instrumentation was mounted over the hood of the tractor in such a way that an additional man could ride and operate the instruments during field operations (Fig. 1). A 110-v generator was mounted on the tractor to power the instruments and a small tape recorder that was used to keep a running account of operating conditions.

Before field tests were conducted, the tractor and its instrumentation were calibrated on a dynamometer for known loads at several hand-throttle settings.

Conduct of Tests

Twelve cooperating farmers were selected who lived close to the university and had equipment suitable for use on or with the test tractor. For one year the test tractor was

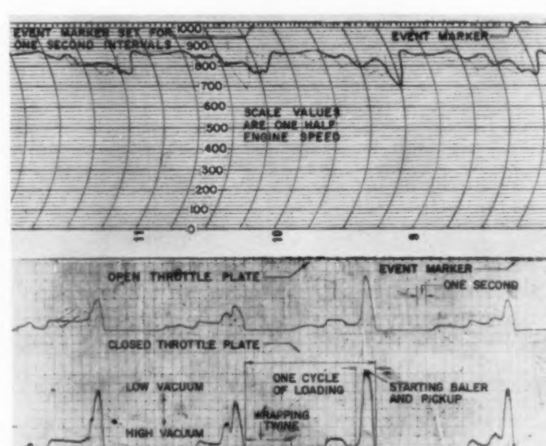


Fig. 2 Recorder charts of engine speed, throttle-plate position, and manifold vacuum for baling with A-C Rotobaler

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Power and Machinery Division.

The authors — C. J. RICKETTS and J. A. WEBER — are, respectively, graduate assistant (now project engineer, Aviation Division, Sunstrand Machine Tool Co., Rockford, Ill.) and associate professor of agricultural engineering, University of Illinois, Urbana.

*Numbers in parentheses refer to the appended references.

substituted for the farmers' tractors for such operations as plowing for a long enough period to obtain records on normal operation and also on such conditions as going through wet or tough spots, going around ends, etc.

Although an effort was made to include as many different operations and conditions as possible, time limited the extent of the study. Not all machines were included, and only the types and sizes of machines used are considered in this paper. For example, a four-row planter used in the tests had fertilizer attachments, but they were not in use. Also, it is to be noted that this study was made in central Illinois on level clay loam soils. Despite these limitations, the results show the tractor loading as it occurred on twelve farms and represents approximately 140 hours of field testing.

Results of Loading Study

For each operation, values of intake manifold vacuum, throttle plate position, and engine speed were taken from recorder charts like those shown in Fig. 2. Corresponding data for the hand throttle or governor-control position and gear and transmission range were also used to determine horsepower requirements and approximate ground speeds in miles per hour.

Table 1 shows some typical conditions for 19 field operations in descending order of their average horsepower requirement. Horsepower requirements for *(a)* starting the equipment or implement and *(b)* average operation through the field are reported in actual values and in percent of maximum horsepower of the tractor. Maximum horsepower was determined with the hand throttle or governor control in the full position and with enough dynamometer load to fully open the carburetor throttle plate.

Starting loads often exceeded the torque available at the maximum horsepower of the tractor. For these conditions of overload, the actual horsepower supplied by the tractor was less than maximum, while the torque was high because of the lower engine speed. These values of overload horsepower are not included in the averages in Table 1.

The operations that farmers generally called heavy work varied from 56 to 97 percent of maximum horsepower. Speeds ranged from 1.8 mph for combining to 12 mph for rotary hoeing.

Individual Operations

Fig. 2 shows a section of recorder charts taken while the test tractor was powering an AC rotobaler. The horsepower required for this particular operation varied considerably

TABLE 1. TYPICAL POWER REQUIREMENTS FOR FARM OPERATIONS

	No. of tests	Starting hp	Percent full hp	No. of tests	Av. hp	Percent full hp	Speed, mph
PLOW — 4-BOTTOM (41.57)*							
Stalk ground, mtd. with trail wheel, slatted moldboard	11	44.4‖	85.1	13	39.6‡	81.5	3.8
Sod ground, mtd. with trail wheel, slatted moldboard	6	47.95‖	98.6	6	45.0‡	92.5	3.3
FIELD CULTIVATOR (41.25)*							
Bean ground, 10-12-in. sweeps, 2-section harrow, 6-in. depth	2	48.6†	100	2	42.3	87.1	4.6
Plowed sod, 10-12-in. sweeps, 2-section harrow, 4-in. depth	4	48.1	98.9	5	41.0	84.4	4.7
ROTARY HOE (40.12)*							
Hoeing corn, 4-section	3	—§	—	2	47	96.8	12
Hoeing small corn, 600 lb. wt. added, 4-section	3	46.1†	94.7	3	44.7	92	12
Hoeing small corn	7	36.8†	75.6	7	27.9	57.4	10.1
CULTIPACKER — Plowed ground, 9 ft width	2	47.4	97.6	3	37.7	77.6	4.6
SPIKE-TOOTH HARROW (35.3)*							
Plowed ground, 20 ft section	4	42.9†	88.3	7	35.7	73.4	5.63
SPRING-TOOTH HARROW — plowed ground, 12 ft width	4	44.9†	92.2	5	33.5†	68.9	5.73
DISK (33.41)*							
Alfalfa plowed, but not harrowed, 9 ft tandem wheel type	2	44.9‡	92.2	2	38.3	78.8	4.55
Stalk ground, spike-tooth-harrowed once, 13 ft tandem	9	42.7‡	86.9	9	37	76.1	3.99
Plowed ground, 11 ft tandem	3	36‡	74	5	32.6	67.1	4.55
Cornstalk ground not plowed, 9 ft tandem	3	45.8	94.2	3	27.4	56.4	4.7
CORN PICKER (26.98)*							
Pull type, 2-row	5	39.9	82.0	12	30.96	63.6	2.67
Picker not running, just pulling full wagon	1	36.6	75.4	1	23	47.3	2.65
CHOPPER (24.5)*							
Alfalfa hay, standing, 5 ft width	1	39	80.2	1	28.3	58.2	4.6
Alfalfa hay, cured, 6 ft width	4	39.2	80.6	7	20.7	42.5	3.38
AMMONIA APPLICATOR							
Disked plowed ground, 5 knives, 1,000-lb tank	4	40.8	83.9	4	26.6	54.7	4.7
CULTIVATOR (21.05)*							
Knee-high corn, 4-row	4	34.7	71.4	6	25.5	52.4	4.95
CORN PLANTER (18.1)*							
Large hoppers, furrow openers, 4-row	3	41.3	84.9	4	26.6	54.7	5.58
Standard hoppers, furrow openers, 4-row	7	36.1	74.3	7	21	43.2	6.25
SUBSOILER — Bean ground in which water stood	11	34.8	71.7	8	16.25	34	3.6
CRUSHER AND MOWER OPERATED TOGETHER (15.5*)							
Alfalfa brome, 7 ft machine	2	37.5	77.2	4	19.4	39.9	4.9
COMBINE — Wheat standing, 5 ft machine	5	23.7	48.7	8	13.9	38.6	1.85
CRUSHER — Alfalfa brome, 7 ft machine	1	37	76.2	3	12.7	26.1	4.9
MOWER — Alfalfa brome, 7 ft crusher using only the mower	1	23.5	48.3	1	11.75	24.2	3.6
RAKE — Alfalfa brome, steel-wheeled rake	1	38.8	79.7	2	9.9	20.4	7.45
TRAVEL — Pulling implements in from field	3	23.4	48.2	3	6.2	12.7	7.08

*Average horsepower for all test runs for this operation.

†, ‡, §, ‖, Respectively groups of tests containing one, two, three and four overloads. "Overload" means that the engine is producing something less than maximum hosepower (48.6) but is developing more torque than at maximum horsepower.

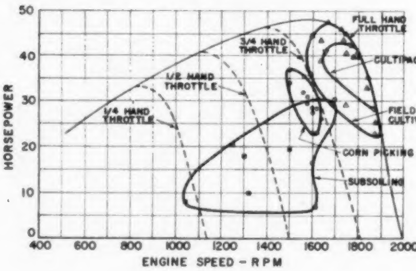
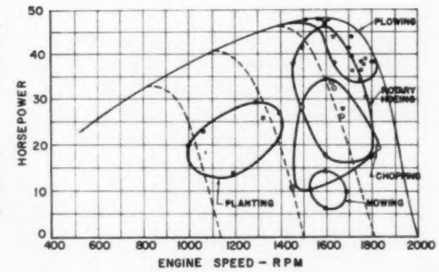


Fig. 3 *(Left)* Range of engine horsepower and speed requirements on test tractor for corn picking, subsoiling, field cultivating and soil packing

Fig. 4 *(Right)* Range of engine horsepower and speed requirements on test tractor for planting, mowing, chopping, rotary hoeing and plowing



as the bale was started and went through one cycle of loading and twine wrapping. Event markers made it possible to determine the power requirement at any point in the cycle.

Power requirements for tandem disking were affected by direction of operation. When the tractor ran parallel to the direction of plow travel, the power requirement was relatively steady (31.7 to 36.0 hp); when it ran perpendicular to the direction of plow travel, there was a considerable amount of fluctuation (22.8 to 39.5 hp).

Within certain boundary limits, a tractor engine can operate at an infinite number of combinations of engine speed and horsepower. The total area of engine potential was determined for the AC D-17 test tractor and is shown in Fig. 3. Included are the curves for full, three-fourths, one-half, and one-quarter hand-throttle settings.

Since several field test runs were made for each farming operation, they were plotted in terms of horsepower and engine speed (Fig. 3). All of the tests for one particular operation outlined an area or range. Approximate ranges of power and speed requirements for 18 operations are shown in Figs. 3, 4, 5, and 6. The ranges are determined by the tractor driver, equipment and field conditions.

Records Kept by the Farmers

Daily record sheets on tractor operation were kept by 25 farmers for one year. This information included kind of operation, size of implement, clock reading for start and stop of the operation, gear used, engine speed, hand-throttle position, and acres covered. Each tractor was equipped with an hour meter. The summary covers over 8,500 hours of tractor operation on central Illinois farms.

How Farmers Use Their Tractors

Twenty-three operations accounted for practically all of the operating time of the 25 tractors. Fig. 7 shows the proportion of time an "average" tractor would spend on each of these 23 operations in one year. The number in each sector is the number of hours per year.

Idling and traveling times were not obtained from these records, but they were estimated to be 12.5 and 5 percent, respectively, on the basis of previous work reported in AGRICULTURAL ENGINEERING by H. P. Bateman (3) and in the Illinois Agricultural Experiment Station report (4).

The 25 tractors were used an average of 340 hours per year, the range being 164 to 627 hours. These values are noticeably lower than those reported in previous studies. However, there are a number of reasons for this difference: The tractors in this study were picked at random and were not necessarily new models or those receiving the most use. Many of the farms had as many as four tractors, the average being 2.6 per farm.

In the 1947-48 studies (4), the average tractor use was 591 hours per year. However, since that time there has been a large increase in number of tractors. Self-propelled equipment has also taken over many of the harvesting operations formerly powered by tractors.

Another Illinois study, started in 1955 with new models, showed a decided drop in hours of use from 1955 to 1959. In 1955 the average hours of use for the 50 tractors was 625; in 1958 it was 498 (5). Where there is more than one tractor per farm, an older tractor is often used fewer hours because it lacks the conveniences found on newer models.

Among the 25 tractors there was considerable variation in the way individual tractors were used. For example, the only tractor on one farm had 627 hours use per year and the distribution was similar to that in Fig. 7. One of four tractors on another farm had highly specialized use with 187 hours of crop drying out of a total of 455 hours.

The number of hours a tractor can be used annually is determined by seasonal requirements. Fig. 8 shows that there are several months in the year when the "average"

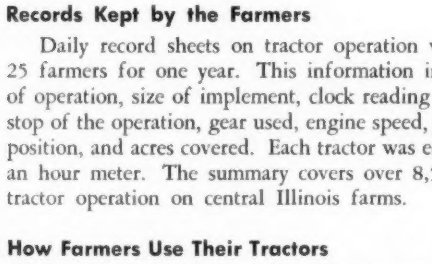
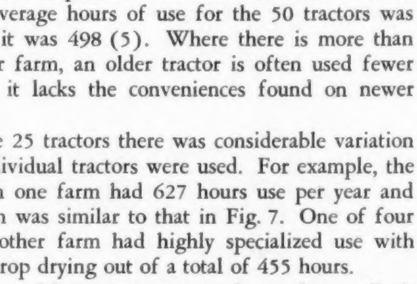


Fig. 5 *(Left)* Range of engine horsepower and speed requirements on test tractor for cultivating, combining, applying anhydrous ammonia, and spike- and spring-tooth harrowing

Fig. 6 *(Right)* Range of engine horsepower and speed requirements on test tractor for raking, crushing, crushing and mowing, and disking



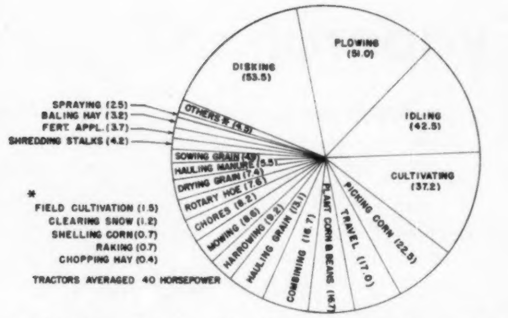


Fig. 7 Distribution of hours of tractor use by operation — average of 340 hours for 25 tractors

tractor in a cash-grain area is used little if at all. The numbers in the sectors of the circle are hours per month.

Information for Tractor Design

Useful design knowledge can be obtained by showing the relationship between tractor use and fuel efficiency at all engine speeds and horsepower outputs. Fuel consumption characteristics of the test tractor were determined, and lines of constant specific fuel consumption were plotted over the entire range of engine speeds and horsepowers (Fig. 9).

Use of loading information in Figs. 3, 4, 5, and 6 and the hours the "average" tractor is used for these various operations made it possible to calculate the number of hours the tractor would be operated at a particular combination of horsepower and engine speed. To make this calculation, areas were constructed on a graph (Fig. 9) with a density of hours of use per square inch. The hours of use per year for these areas were determined by dividing the entire range of engine speeds and horsepowers into small uniform areas (Fig. 10). For example, this "average" tractor would be used 16 hours per year between 1600 and 1700 rpm at power requirements between 40 and 45 hp. Areas containing zero hours per year were not used in the operations studied on the test tractor.

Fuel Consumption

After the data in Fig. 10 were obtained, the fuel consumption in gallons per year could be calculated for any particular combination of horsepower and engine speed. Fig. 11 is the result of calculations using the equation:

$$\text{Gallons/year} = \text{hours/year} \times \text{1b/hp-hr} \times \text{gal/1b} \times \text{hp}$$

Fig. 9, which shows tractor performance at all speeds and loads, was again used as the basis for the calculation.

More than 600 of the 1,000 gal of fuel used per year are consumed at speeds above 1500 rpm and requirements above 25 hp. Therefore, in the redesigning of carburetors for better part-load efficiency, good fuel efficiency must be maintained at higher engine speeds and loads.

Dividing the total fuel consumption per year (1000 gal) by the hours per year (340) gives an average fuel consumption per hour of 2.97 gal. Checking this rate on the fuel consumption curve of the AC D-17 test tractor shows an average load of 26.5 hp, or 54.7 percent of maximum tractor horsepower.

The Nebraska test for the AC D-17 tractor shows a fuel consumption of 2.91 gal per hour for the third line of Test E, which compares favorably with the 2.97 gal per hour obtained in this study. This indicates that the fuel consumption listed in the third line of Test E or the third line of the new varying power and fuel consumption test (one-half load) is a reasonable one to use when estimating fuel consumption for the year in central Illinois. It is interesting to note that the day-to-day fuel consumption records taken in 1947-48 and the yearly consumptions recorded in the study started in 1955 also show the average fuel consumption per hour for a year to be equal to the third line of Nebraska Test E. Even though the types of operations have changed over the years, the average horsepower requirement for a year continues to be about 50 percent of maximum.

(Continued on page 250)

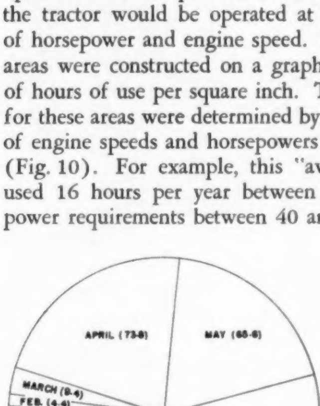


Fig. 8 ***(Left)*** **Distribution of hours of tractor use by month — average of 340 hours per year for 25 tractors**

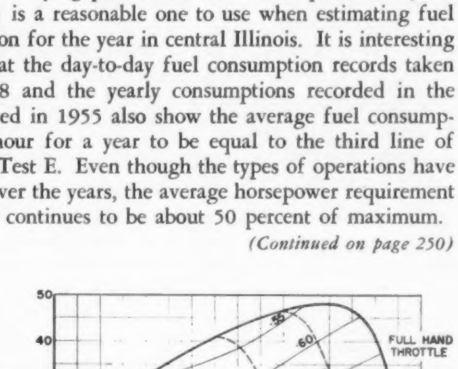


Fig. 9 ***(Right)*** **Specific fuel consumption of test tractor for all possible power requirements**

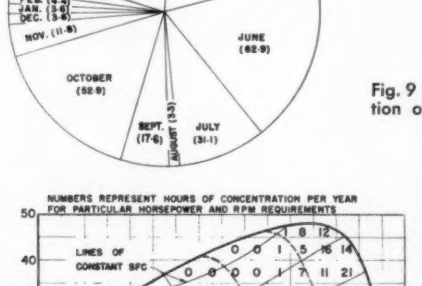


Fig. 10 ***(Left)*** **Comparison of concentration of hours of use with test tractor specific fuel consumption**

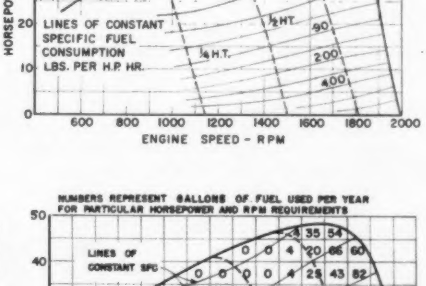


Fig. 11 ***(Right)*** **Comparison of gallons of gasoline used per year with test tractor specific fuel consumption**

Reducing Reservoir Evaporation

F. R. Crow
Member ASAE

Application of surface films cuts losses

THE demand for more water for all purposes has stimulated research in all phases of conservation and efficient utilization of water. Evaporation from lakes and reservoirs has been recognized as a major source of water loss. It is natural, therefore, that a considerable amount of research has been directed toward reducing this evaporation. Much of this effort has been concerned with developing application systems and evaluating the effects of applying very thin chemical films to the water surface. Hexadecanol, a long chain fatty alcohol, is the chemical that has been tested most frequently.

Early laboratory experiments by Rideal (1)* and Langmuir (2) showed that a film of hexadecanol or similar fatty alcohols would significantly reduce evaporation. The effectiveness of hexadecanol in reducing evaporation from small vessels was demonstrated when reductions of 33 to 60 percent were obtained in tests made in standard 4-ft evaporation pans. The remaining problem was to develop effective methods of applying the film to large bodies of water and to evaluate its effectiveness when exposed to winds and waves found in field conditions.

In 1956, the Oklahoma Agricultural Experiment Station initiated a research project designed to provide data on the effectiveness of chemical films† for evaporation suppression on reservoirs of a size found on most farms and ranches. The purpose of this paper is to present a summary of four years of research and to discuss results of tests in which a hexadecanol film was maintained on an experimental pond over a period of four months.

Experimental Facilities and Procedure

The testing facility consists of two adjacent ponds, 100 by 120 by 7.0 ft, lined with a buried vinyl plastic membrane. Numerous calibration tests have shown seepage to be negligible. The ponds are located on the crest of a broad ridge and therefore have no outside drainage area, water being supplied by the University water system. Changes in the water level are observed at 12 to 24-hr intervals with a micrometer-type point gage. A recording self-balancing potentiometer is used to measure air and water temperature. Wind speeds are measured with a totalizing anemometer set at a height of two meters above the mean water surface.

The procedure for making a test is to fill both ponds to the same elevation, cut off the water supply, and make a seepage calibration test. A treatment is then applied to one of the ponds and continued for a sufficient number of days to obtain the necessary data.

Methods of Application

Three different methods of application were tested: *(a)* raft application, *(b)* solution feeder, and *(c)* continuous application of hexadecanol in water slurry.

The raft method was the first to be tested, since it had been reported successful in Australia (3). With this method of application the source of chemical film is a supply of hexadecanol pellets or flakes contained in screened rafts floating on the water surface. A series of tests made in 1957 on the experimental ponds showed the raft method to be quite ineffective. Evaporation reduction amounted to five percent or less (4).

The next approach was to devise a simple solution feeder to make the film more readily available for spreading over the pond surface. Ethyl alcohol was used as the solvent. With this device, octadecanol was applied at an average rate of 0.75 lb per day. Evaporation was reduced 12 percent during a 17-day test (5). Although better than the raft method, this technique was unsatisfactory because there was no means for varying the rate or point of application as required by varying wind speed and direction. Further, frequent stoppages in the feeder presented serious maintenance problems, especially in cool weather.

In 1958 an apparatus was developed for the continuous application of powdered hexadecanol to the pond surface as a slurry. Automatic controls‡ regulate the rate and the point of application of the film in response to wind speed and direction. The system has been satisfactory for experimental purposes.

Paper presented at the Winter Meeting of the American Society of Agricultural Engineers at Memphis, Tenn., December 1960, on a program arranged by the Soil and Water Division. Approved as Oklahoma Agricultural Experiment Station Manuscript No. 627.

The author — FRANKLIN R. CROW — is associate professor of agricultural engineering, Oklahoma State University, Stillwater.

*Numbers in parentheses refer to the appended references.

†Chemicals were furnished through the courtesy of the Archer-Daniels-Midland Co., Minneapolis, Minn.

‡The assistance of James E. Garton in the design of the controls for the slurry application system is gratefully acknowledged.

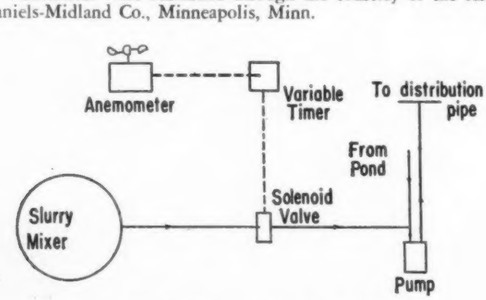


Fig. 1 The rate-control system

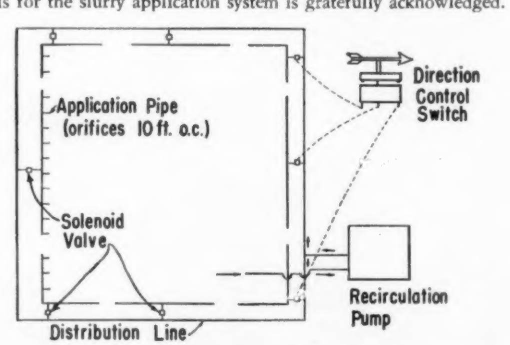


Fig. 2 The distribution system

The principal components of the slurry application apparatus are the rate control system (Fig. 1) and the distribution system (Fig. 2). The slurry of hexadecanol powder and water is contained in a steel drum and agitated continuously by an electrically powered paddle-type agitator unit. Metering of the slurry concentrate is controlled by a solenoid valve that is opened upon signal from a cup-type anemometer after each 1/10 mile of wind passage. The time interval during which the valve remains open is controlled by an automatic reset time-delay process timer, variable from one to 15 sec.

The elements of the distribution system are shown in Fig. 2. Water from the pond, circulated by an electric pump through a one-inch distribution line, serves as a diluting and transporting medium for the hexadecanol slurry. The slurry concentrate is introduced into the suction side of the pump and applied to the pond through application hoses perforated at 10-ft intervals. The hoses are located for maximum coverage when any three adjacent solenoid valves between the distribution and application lines are opened by the wind-direction sensing switch.

Evaporation Reduction

The first successful test using the slurry application system on a 24-hour-per-day basis was made in October, 1958. The results of this test, shown in Fig. 3, tended to confirm the reductions predicted by the laboratory and evaporation-pan tests referred to above. Evaporation from the pond on which a film of hexadecanol had been maintained averaged 39.4 percent less than from the check pond. The average reduction during the first three days of the pond test was 48.7 percent. This compared favorably with reductions of 47.5 percent achieved in a concurrent test of the same chemical applied to water contained in standard evaporation pans.

With the coming of cold weather there were no further tests in 1958. Encouraged by the results of the October tests, an extensive testing program was carried out in 1959. From July through October, tests were made on nearly every day that weather conditions would permit. The procedure followed was basically the same as for the October 1958 tests. Hexadecanol slurry was applied continuously day and night (except during the interrupted application test discussed later in this paper). Every effort was made to assure that a film was being maintained on the treated pond. An attendant was at or near the ponds during the daylight hours and inspections were also made several times between sunset and midnight. In this manner a complete film was maintained on the treated pond for 66 days during the summer and fall of 1959.

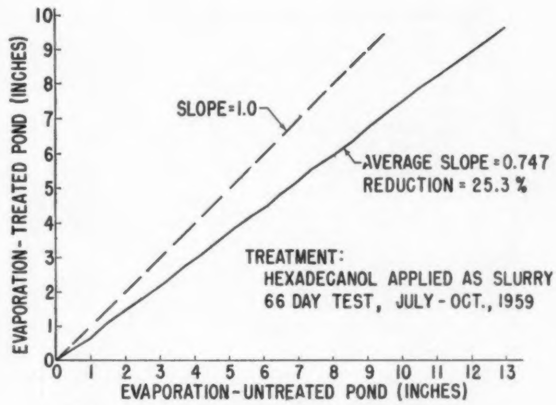


Fig. 4 Effect of hexadecanol on pond evaporation

The results of the 1959 tests are shown in the double mass curve in Fig. 4. The average reduction was 25.3 percent. Percentagewise evaporation reduction was consistent from month to month. The 25.3 percent reduction is particularly significant when compared with those obtained in the raft and solution-application tests. However, it is considerably less than the 39.4 percent reduction achieved in October, 1958. The reason for this difference is not entirely clear. However, the evidence appears to point to dissimilar water temperatures within the two ponds as the possible cause.

Effect of Film on Water Temperature

From an energy budget standpoint, it is to be expected that a reduction of evaporation will be accompanied by an increase in the water temperature in the reservoir. The temperature differential thus induced by suppressing evaporation may have an important effect on subsequent evaporation reductions. To test this hypothesis, thermocouples were placed one-half inch, one foot, and five feet below the water surface of each pond and temperatures obtained with a recording potentiometer. The results for one typical summer day are shown in Fig. 5. For this 24-hr

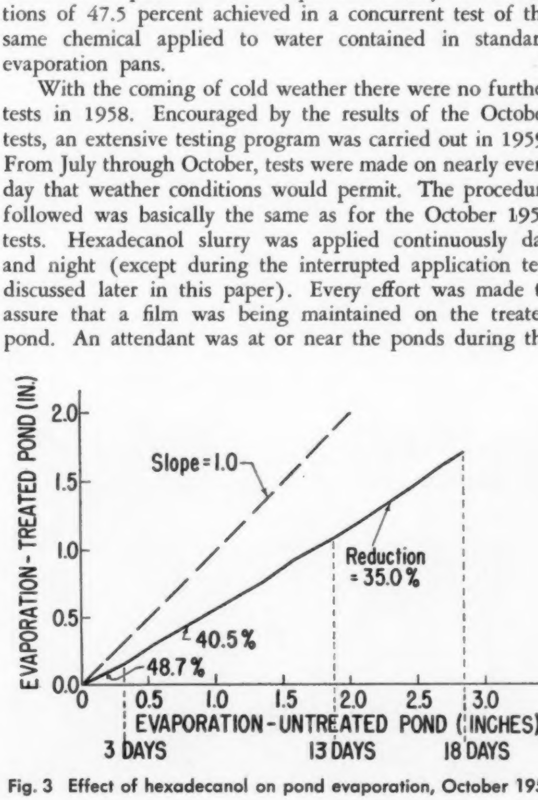


Fig. 3 Effect of hexadecanol on pond evaporation, October 1958

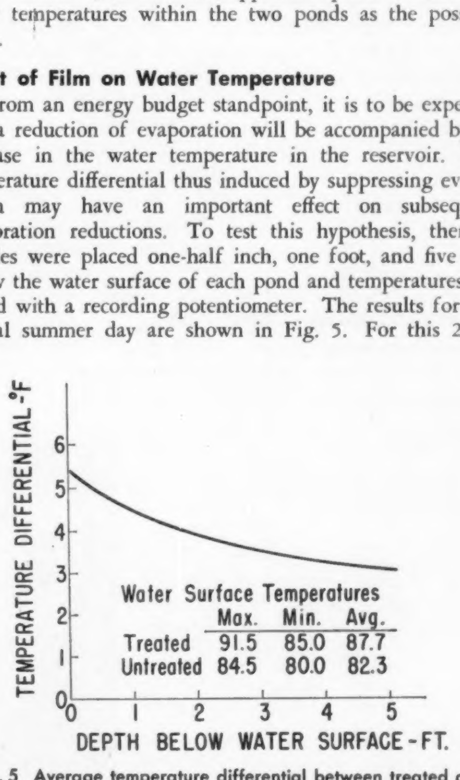


Fig. 5 Average temperature differential between treated and untreated ponds, August 20, 1959

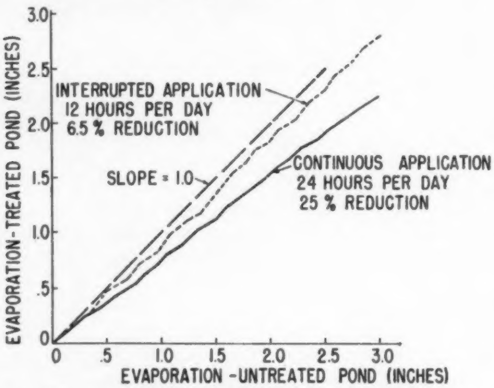


Fig. 6 Effect of interrupted application of hexadecanol film on evaporation reduction (24-day test, August 1959)

period the average temperature differential was 5.4 F at the surface and 3.0 at a depth of five feet. The maximum temperature differential at the surface was 7.0 F.

Referring again to the October 1958 tests (Fig. 3), it will be seen that the double mass curve may be separated into at least three parts, each having a different slope. For the first three days both ponds were at essentially the same temperature and conditions for evaporation suppression were optimum, the reduction being 48.7 percent. As the test progressed and more energy was stored in the treated pond, evaporation reduction decreased to an average of 40.5 percent from the third to the thirteenth days and to 35 percent from the thirteenth to the eighteenth day. It may be expected that this same trend would continue until all of the influencing factors became balanced. This same phenomenon was observed during the first few days after the start of the July 1959 tests, when a reduction of 40.9 percent was achieved for the first day, compared with the average for the month of 26.7 percent. While further research on this aspect of the problem is desirable, it is apparent that long duration tests are much more reliable than those of short duration. In fact, tests of 12 to 24 hours or even a few days may be quite misleading.

Effect of Interrupted Application

Any mechanical system of application is subject to stoppage resulting from equipment breakdown, power failure, or other causes. Also, the application of film may be interrupted intentionally, e.g., at night on the assumption that evaporation losses during the night may be negligible. Such interruptions may have an effect on the heat balance within the treated pond, resulting in abnormally high evaporation rates when the film is removed. To determine the effect of interrupted application, tests were made in which film was applied only during the 12-hr period from 9:00 a.m. to 9:00 p.m., none being applied from 9:00 p.m. to 9:00 a.m. As a check, on alternate days the film was applied continuously for 24 hours. The tests were made in typical summer weather in August 1959 over a 24-day period, 12 days for each condition. The results are shown in the double mass plotting in Fig. 6. It is apparent that removing the film at night had an adverse effect, since net evaporation reductions were only 6.5 percent during the interrupted application tests. The 25 percent reduction obtained during the check periods is identical with the average reductions for the entire season. The practical implication of this finding is that, once started, film application should be continued throughout the evaporation season and should not be stopped at night.

Effect of Wind

Hexadecanol film reduces the surface tension of water, resulting in the smoothing of small waves when the film is applied (Fig. 7). This smoothing action also serves a practical purpose by providing an easy and reliable method of determining whether a film is present. Other tests, particularly the spreading pressure indicator oils (6), have been developed to detect the film. However, numerous tests with the indicator oils have shown that the absence of waves, in winds normally strong enough to create them, is a valid test of film presence.

Experience with hexadecanol films shows that they are easily driven across the water surface by the force of wind. Once blown to the downwind side of the reservoir, the chemical is deposited along the shore and is no longer available for reducing evaporation. The rate of application of hexadecanol required to replace the film removed by the wind is therefore a function of the length of upwind shoreline normal to the wind direction and the wind speed.

Fig. 8 shows the result of tests to determine the effect of wind on the application rate required for a complete film cover. Each point on the curve represents a test of several hours duration during which the wind speed and direction remained constant. Throughout each test the application rate of slurry of known concentration was controlled in such a manner that the rate of replacement of the film equalled,

Fig. 7 Effect on hexadecanol film on wave action. Surface of treated pond, in background, remains smooth during 12-mph wind

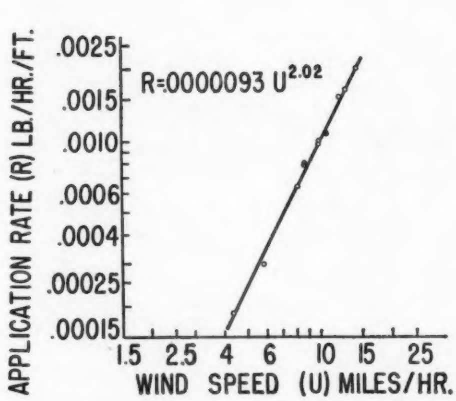


Fig. 8 Application rate required to replace hexadecanol film removed by wind

but did not exceed, the rate of removal by the wind. The condition of the water surface was used as the criterion as to whether a sufficient film was present. The equation for the curve is $R=0.0000093\ U^{2.02}$, where R is the required application rate in pounds per hour per foot of upwind shore line normal to the wind, and U is the wind speed in miles per hour at a point two meters above the water surface. The maximum wind speed shown on the curve, 14 mph, when converted to its equivalent speed at the higher levels reported at the Class A weather bureau stations, is approximately 25 mph. For a short time a satisfactory film was maintained during winds of 18 mph, but the required application rate was considered to be extravagant. Since the rate of removal is disproportionately large for very high wind speeds, it appears that there is some limiting wind speed above which it is impractical to attempt to maintain a film.

Economics of Evaporation Retardation

The cost of saving water by evaporation retardation depends upon *(a)* climate, *(b)* wind speed, *(c)* shape and orientation of the reservoir with respect to prevailing winds. Climate is important because greater unit reductions are possible in hot, dry, windy regions having high evaporation rates than in cool, humid regions with moderate evaporation rates. The required application rate varies as the square of the wind speed, as previously noted. For any given reservoir, the application rate also depends on the length of upwind shore line measured normal to the wind. The orientation of the reservoir is therefore an important factor in the economic analysis. Thus a long narrow reservoir with the long axis parallel to the prevailing wind will require less hexadecanol per unit of area than the same reservoir rotated 90 deg.

An economic analysis was made to estimate the cost of water saved during an 11-day period. The weather was typical for August with hot days and wind speeds averaging 7.0 mph during the day and 4.5 mph at night. The volume of water saved was 5800 gal, equivalent to a depth of 0.78 in. and a reduction of 24 percent. For the analysis it was assumed that *(a)* the wind was always parallel to the long axis of the pond, *(b)* film application was at the minimum possible rate as determined from Fig. 8, and *(c)* the cost of hexadecanol, at 50 cents per pound, would be the only charge. Equipment, power, and labor costs were not included. On this basis it was estimated that 8.55 lb of hexadecanol would have been required, resulting in a cost of 89 cents per thousand gallons of water saved. The important influence of reservoir orientation is apparent. The test pond was nearly square, being 120 ft by 100 ft. If this reservoir had been of the same area, but with the long axis five times the width, the cost of water saved would have been only 18 cents per thousand gallons.

Summary

1 The results of four years of research on the suppression of evaporation from experimental reservoirs by chemical films of hexadecanol and octadecanol are presented in this paper. A major objective of this study was to develop and test equipment for applying the chemical film. The development of an experimental apparatus for the continuous application of a slurry of water and powdered hexadecanol is described. With this system it was possible to maintain a chemical film on the experimental pond for prolonged test periods. Evaporation was reduced by 25 percent during a 66-day test in 1959. Water temperature increased as a result of the evaporation suppression. At the surface the water temperature was increased by 5.4 F, and at the five-foot depth the temperature was 3.0 F higher than that of the check reservoir.

2 An experiment was performed to determine the effect of intermittent application of the film. When the film was applied only 12 hours per day, evaporation was reduced by 6.5 percent, compared with 25 percent reduction when the film was applied 24 hours per day. The apparent cause for this difference is the higher energy content of the reservoir on which evaporation has been suppressed, resulting in higher evaporation rates when the film is removed.

3 Tests were made to determine the effect of wind speed on the rate of removal of the film. The equation for this relationship was found to be $R=0.0000093\ U^{2.02}$, in which R is the application rate of hexadecanol required for a continuous film, in pounds per hour per foot of upwind shore line normal to the wind, and U is the wind speed in miles per hour two meters above the water surface.

4 An economic analysis to determine the cost of saving water by evaporation retardation during an 11-day period of typical August weather showed the cost to be 89 cents per thousand gallons. This cost will vary for other locations, depending on the factors of climate, daily wind speed, and the shape and orientation of the reservoir with respect to prevailing winds.

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Energy Requirements for Forming Hay Pellets

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(Continued from April)

PROCEDURE

Third-cutting, whole alfalfa hay was cut with a scythe and placed on metal-screen drying racks. The racks were sheltered overhead, but were open on two sides and underneath for free circulation of air.

Relationships of factors affecting hay pelleting, such as moisture content, pressure, density, *et al*, were established by Butler (3) and Hill (4). Hence this investigation was more concerned with quantitative values of pelleting energy than with repeating work previously conducted. Therefore, close control of moisture content was not attempted. After the hay had dried to the desired moisture content, it was weighed out in 40-gram samples and placed in individual paper bags. A sample of hay was placed in the hopper of the machine. It was forced into the feed chamber of the receiving cylinder. A cover was then locked in place to form a closed cylinder. PTO torque powered the baler crank through one revolution (at a rate of about 17 rpm), and compressed the sample of hay by a single stroke of the piston.

The pelleting chamber was rotated to ejecting position and clamped in place. An assistant ejected the pellet by turning the handcrank at a uniform rate of rotation until the pellet was expelled. The foregoing procedure was carried out for all samples.

After the 15 samples of hay for each test had been pelleted, they were weighed on a gram balance. When expansion rate became insignificant, after 30 minutes (3), length and diameter of the pellets were measured. Pellet density (pounds per cubic foot) was determined by entering the values of length, diameter, and pellet weight into a slide rule made especially for this purpose (3). Moisture content of each sample was determined gravimetrically. Values taken from both the force and displaceement charts were plotted on rectangular coordinate paper, giving a force-displacement curve for each pellet.

A planimeter was used to measure the area under the curves; energy was calculated by converting the area to foot-pounds. Dividing the value of foot-pounds by the pellet weight and multiplying by a constant (0.458), which incorporated grams/pound, pounds/ton, and foot-pounds/horsepower-hour, gave the energy requirements for compressing the hay in horsepower-hours per ton. Maximum applied forces were recorded.

In order to create pelleting pressures above 2,000 psi, a ⅜-in. spacer was mounted between the piston force transducer and the baler plunger head. This moved the end position of the piston stroke further into the pelleting chamber.

It was originally planned to determine the ejecting energy by force-displacement plots as described for compressive energy. But displacement curves for each sample had constant slopes, indicating uniform rate of displacement for each ejection. By determining the total distance the ejecting ram moved (from oscillograph tapes not shown) and the time required for each ejection, the rate of ejection in feet per second was calculated. This eliminated the necessity of plotting force-displacement curves. The product of ejecting velocity (feet per second) and force curve area (pound-seconds) was the ejecting energy (foot-pounds) for each pellet. These values were expressed as horsepower-hours per ton for each pellet.

Values of relationships were plotted, using the method of least squares to determine slopes and intercepts, on rectangular coordinate paper. Curves were drawn, not to establish mathematical relationships, but to determine trends of quantitative values.

The above procedure and method of analysis was performed for applied pressures of approximately 1,800 and 3,500 psi. Plans called for pelleting batches of hay at three different moisture-content levels (15 samples for each) for both pressure tests. Average moisture content of the first batch of pellets (test D, Table 1) at 3,500 psi was only 4.6 percent instead of the desired 12.5 percent. Delay caused by machine breakdown resulted in excessive drying of hay. Shortage of hay made a rerun at the desired moisture content impossible.

Mathematical averages of the moisture content values of the 15 pellets of each batch were computed, and deviations from the mean values were determined. Relationships were based on the ten samples having the least deviation from the mathematical mean moisture content of each 15-pellet lot.

TABLE 1. ENERGY REQUIREMENTS FOR COMPRESSING AND EJECTING WHOLE ALFALFA HAY IN CLOSED-END CYLINDER

Test	Pressure applied, psi	Moisture content, percent (w.b.)	Pellet density, lb/ft³	Compressive energy, hp-hr/ton	Hydraulic energy*, hp-hr/ton	Ejecting energy, hp-hr/ton	Total energy†, hp-hr/ton
A	1,818	12.5	35.2	3.35		0.31	3.7
B	1,804	17.0	33.2	2.91		0.26	3.2
C	1,685	21.3	28.6	2.37		0.31	2.7
D	3,534	4.6	42.1	4.71	2.84	0.67	8.2
E	3,474	17.4	36.9	4.08	1.63	0.63	6.3
F	3,384	21.1	34.3	3.34	1.40	0.51	5.2

*Energy consumed by hydraulic pressure control device.
†Total values rounded off to nearest 0.1 horsepower hour per ton.
NOTE: All the above values are mathematical averages of ten pellets having least moisture content deviation from mathematical mean of 15-sample lots.

Two additional tests were conducted to determine the effect of the pelleting pressure on ejecting forces. Only five pellets were made for each determination.

RESULTS AND DISCUSSION

Energy of Pellet Compression

A typical force-displacement curve for compressing a single pellet is shown in Fig. 5. The areas under all such curves obtained were converted to horsepower-hours per ton of hay as outlined under the subheading "Procedure." Experimental results of energy calculations appear in Table 1.

A graph of energy versus pelleting pressure (Fig. 6) indicated a trend of increasing energy requirements with increasing pressure. Comparison of 17 and 21-percent moisture-content hay in the energy versus pressure relationship indicated that energy requirements for compressing hay increased as sample moisture content decreased. This is more clearly illustrated by a graph of energy versus moisture content (Fig. 7).

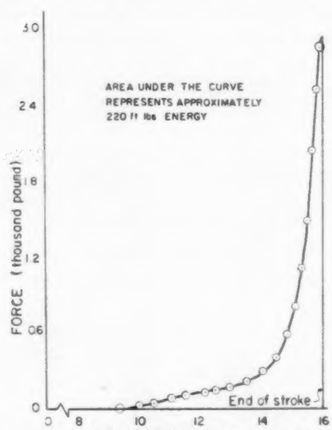
Inspection of results (Table 1) revealed variations in applied pressures for tests which were to have been conducted at constant pressure. The pressure-control device was such that highly accurate control was impossible from one test to the other. But, as stated under "Procedure," the investigation was intended only to determine quantitative trends.

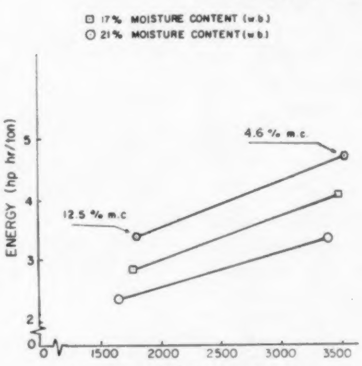
Inspection of Fig. 5 suggests the improbability of any serious effect caused by the slight differences in maximum applied pressures. The greater portion of compressive energy for each sample was expended during the first part of the piston stroke (up to 15 in.) as indicated by the area under the curve (Fig. 5). Increasing the maximum applied force at the apex of the energy curve would result in only a slight increase in total energy expended.

With the exception of test D (Table 1), moisture-content control from one test to the other was quite satisfactory. Low and high-pressure tests C and F showed an average difference of only 0.2 percent. The difference between tests B and E was 0.4 percent. Comparison of tests A and D probably is not entirely justifiable, but the slope of the resulting curve (Fig. 6) was essentially the same as for the 17 and 21 percent moisture-content curves. Evidence of the effect of the low (4.6 percent) moisture content can be seen in the lesser slope of the upper curve of Fig. 7.

It would be incorrect to assume that either curve represents a true mathematical relationship, but the upper curve shows that the trend does not change appreciably, even at extremely low moisture content levels.

The force versus displacement curve of Fig. 8 shows the effect of extending the piston stroke further into the





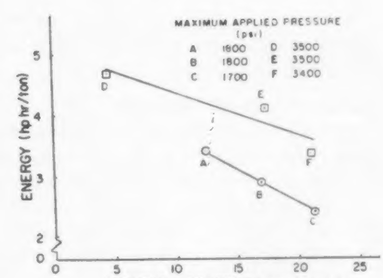
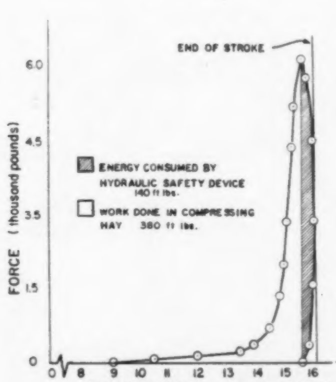
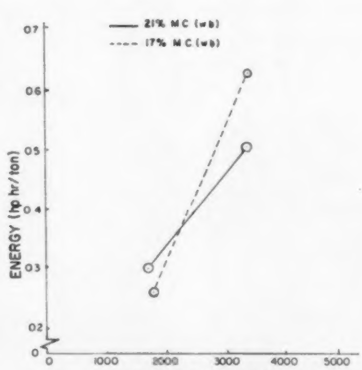


Fig. 5 *(Left)* **Typical energy curve for compressing a single pellet • Fig. 6** *(Middle)* **Compressive energy requirements in relation to applied pressure and moisture content • Fig. 7** *(Right)* **Effect of moisture content on energy requirement for compression**





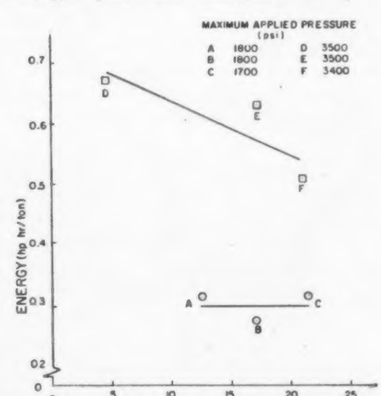


Fig. 8 *(Left)* **Energy consumed by hydraulic safety device, in addition to compressive eneregy • Fig. 9** *(Middle)* **Energy required to eject pellets from closed-end cylinder related to maximum compression pressure • Fig. 10** *(Right)* **Effect of moisture content on pellet-ejection energy requirements**

pelleting chamber to obtain higher pelleting pressures. It is the same type of curve as obtained at lower pelleting pressures (Fig. 5), up to the point of maximum applied force. At that point, the hydraulic relief valve opened, but did not relieve the force opposing the motion of the pelleting chamber rapidly enough to completely eliminate the force of the piston against the compressed hay. When the maximum force occurred (top of curve), the hay was compressed as much as was apparently possible by that force. The piston continued its forward motion, doing work on the hydraulic system, through a distance approximately equal to the extended distance of the stroke, without doing apparent work on the hay. Energy consumed by the hydraulic system was represented by the cross-hatched area under the curve (Fig. 8).

Energy consumed by the hydraulic system represented a 37 percent increase over energy required to compress hay.

Energy consumed by the hydraulic control decreased as sample moisture content increased. Highest average values of energy consumed by the hydraulic control were for 4.6 percent moisture-content hay compressed under 3,500 psi (Table 1, test D). The 2.84 hp-hr per ton absorbed by the hydraulic device amounted to 60.5 percent as much as was required to form the pellet. This quantity of energy indicated the need for development of a control and safety device which consumes little or no energy.

At higher pressures, energy consumed by this type of system would be considerably greater. The pelleting piston of this device performs work on the hydraulic system at pressures very near to maximum pelleting pressures. Even a slight displacement at high pressures would require great quantities of energy.

Energy of Pellet Ejection

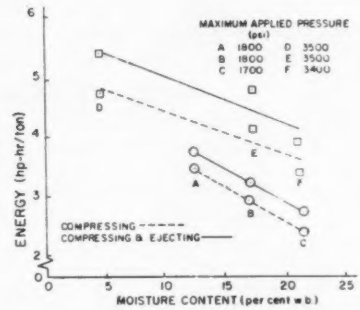
Energy requirements for ejecting the pellets for which compressive energies were determined also appear in Table 1, expressed as horsepower-hours per ton of hay. Graphs of energy versus pressure (Fig. 9) and energy versus moisture content (Fig. 10) revealed inconsistencies in the results recorded in Table 1. Fig. 10 shows that the energy required to eject pellets of 21 percent moisture content, compressed at 1700 psi (test C), was approximately the same as that required for 12.5 percent moisture-content hay at 1800 psi (test A).

The upper curve shows a definite trend of decreasing energy requirements with increasing moisture content. It suggests that either the value for test C should be in the vicinity of 0.2 instead of 0.3 hp-hr per ton or that tests A and B should both show higher energy requirements.

Calibration of the ejecting transducer and energy computations were rechecked, but were found to be in order. A possible explanation of the inconsistency for the low-pressure tests might be that the inner surfaces of the pelleting chamber, during the first tests (low pressure tests A, B, and C), were not polished or coated with hay particles to the same degree as in the subsequent tests. Two-day intervals elapsed between each of tests A, B, and C, but the remaining three tests were performed the same day. Thus, pelleting chamber inner surfaces may have been more nearly alike for each of tests D, E, and F.

Combined energy requirements for compressing hay and ejecting the pellets are shown in energy versus moisture

Fig. 11 Effect of moisture content on pellet compression and ejection energy



content relationships in Fig. 11. Values of ejecting-energy and compressing-energy were added for each of the moisture content values to obtain the total-value curves (solid lines). Average ejecting energy values amounted to approximately 10 percent of the energy required for compressing pellets at 1,800 psi and 15 percent of compressive energy at 3,500 psi.

Ejecting Forces Encountered

For each of the applied pressures within an approximate range of 2,100 to 4,700 psi, five 40-gram samples of hay were pelleted and ejected. Maximum forces encountered in overcoming static friction of pellets against chamber walls and in maintaining ejecting motion are presented in Table 2.

Average values of each 5-pellet lot of the two tests (No. 1 and No. 2) showed that maximum forces required to maintain motion were greater than initial peak forces

TABLE 2. FORCES REQUIRED TO EJECT WHOLE ALFALFA PELLETS FROM CLOSED-END CYLINDER

Moisture content, percent, w.b.	Density, lb/ft³	Pelleting pressure, psi	Initial peak force*, lb	Maximum moving force†, lb
		Test No. 1		
15.4	37.1	2,114	136	183
14.5	40.8	2,777	140	205
14.4	43.0	3,398	146	210
13.9	47.9	3,960	150	227
13.9	49.9	4,624	161	233
		Test No. 2		
14.8	42.5	3,445	190	219
14.8	42.1	3,776	208	257
14.4	46.8	4,684	231	288

*Force required to overcome static friction.
†Maximum force required to maintain motion.
NOTE: All the above values are mathematical averages based on 5-pellet sample lots.

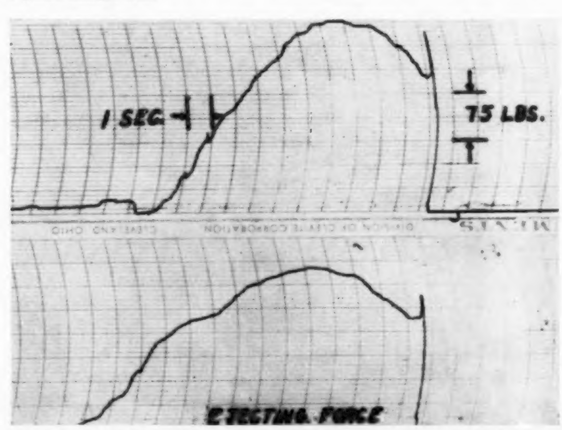


Fig. 12 Typical oscillograph records of forces required to eject pellets from closed-end cylinder. Initial peak forces are at right

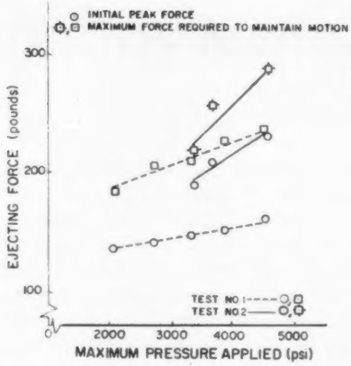


Fig. 13 *(Left)* **Effect of moisture content on maximum ejection forces from closed-end cylinder**

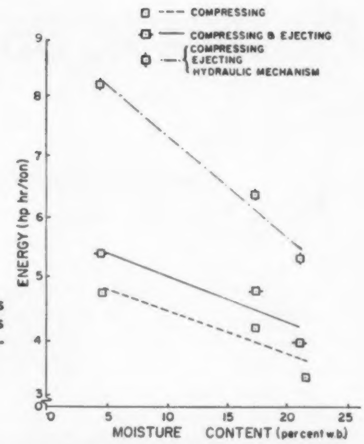


Fig. 14 *(Right)* **Total energy requirements for compressing and ejecting pellets, plus energy consumed by hydraulic-control device at pelleting pressure of 3500 psi**

required to overcome static friction. This was well illustrated by the oscillograph records of ejecting forces (Fig. 12), and by the graphs of ejecting-force vs. pressure (Fig. 13).

The difference in slopes of tests No. 1 and No. 2 (Fig. 13) reveal inconsistencies similar to those experienced in ejecting energy determinations. This effect would be more noticeable in ejecting forces and energies than in compressive forces and energies because of the greater sensitivity of the ejecting transducer relative to the pelleting-force transducer.

Total Energy Requirements

Values of total energy for compressing hay, ejecting the pellets, and that consumed by the hydraulic pressure-control device were presented in Table 1. Total energies for the low-pressure tests consisted only of compressing and ejecting energy shown by the solid line ABC of Fig. 11.

Component and total energy requirements for pelleting hay at 3,500 psi appear in Fig. 14. This graph illustrates the significance of the energy absorbed by the hydraulic pressure-control device. At 21 percent moisture content (which might be considered field conditions) and 3,384 psi, total energy required was 5.2 hp-hr per ton of hay (Table 1). Of this total, 63.6 percent was used for compressing hay, 9.6 percent for ejecting, and 26.8 percent was absorbed by the hydraulic system.

Of the total 8.2 hp-hr per ton required for pelleting low-moisture-content (4.6 percent) hay at 3,534 psi, 57.4 percent was consumed for compressing, 8.1 percent required for ejecting, and 34.5 percent was dissipated by the hydraulic control system.

Handling Durability Tests

Limited handling durability tests, using the tumbler previously described, indicated high degrees of pellet stability. Pellets having 12.3 percent moisture content, 43 lb per cu ft density, and compressed at 3,450 psi (average for the five samples) retained 98 percent of their initial weight after 10 cycles in the tumbler (test A, Table 3).

TABLE 3. HANDLING DURABILITY OF WHOLE ALFALFA PELLETS*

Test	Applied pressure, psi	Initial pellet density, lb/ft³	Moisture content, percent, w.b.	Final pellet density, lb/ft³	Percent of initial weight remaining, percent: 10 cycles	20 cycles
A†	3,450	43	12.3	—	98	—
B‡	1,800	29	17.3	27.5	92	89

*40-gram pellets, 1.50 in. diameter, made from long hay.
†One 5-pellet sample lot.
‡Average of two 5-pellet sample lots.

Fig. 15 Effect of handling 43 lb per cu ft, 12.3 percent moisture content, 3450 psi pellets: (1) pellets not handled, and (2) pellets after 10 cycles in testing tumbler

Integrity and stability of the pellets were not seriously affected by the handling tests (Fig. 15).

Less dense (29 lb per cu ft) pellets made from 17.3 percent moisture-content hay at 1,800 psi (test B) did not withstand handling as well as the more dense pellets of test A. But, after 10 cycles, 92 percent of initial pellet weight remained intact; 89 percent remained after 20 cycles.

Integrity of the pellets after 20 cycles (Fig. 16) appeared to be such that they would withstand additional handling. Abuse beyond 20 cycles would probably be much more severe than would be encountered in normal on-the-farm operations.

Pellet Density

Butler (3) obtained pellet densities averaging approximately 41 lb per cu ft in compressing 40-gram samples of long alfalfa (moisture content range of 12 to 20 percent) in a 1.50-in. diameter cylinder at about 3,500 psi. Results of this investigation show that average pellet densities of 36.9 lb per cu ft were obtained when 17 percent moisture

(Continued on page 250)

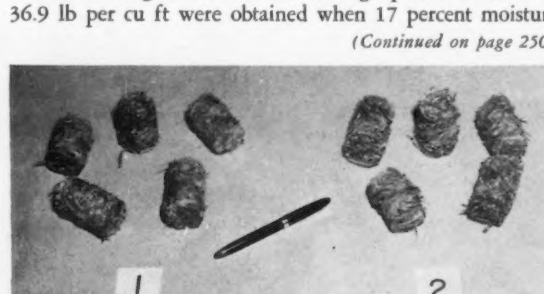


Fig. 16 Effect of handling low-density 29 lb per cu ft, 17.3 percent moisture content, 1800 psi pellets: (1) before handling and (2) after 20 cycles in testing tumbler

Plastics in Soil and Water Conservation

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(Continued from April)

The rate with which plastic linings are accepted for pond use is a simple function of the economics of water value. Few ponds will be as clear cut as the one in California that had a seepage loss of two acre-feet per day. Water pumping cost was $7.50 per acre-foot and the pond was used 300 days per year. The loss, therefore, was 2 ft times $7.50 times 300 days, or $4,500.00 per year—or twice the cost of the plastic liner. In most cases a more complete cost-benefit ratio analysis would have to be made. Cost factors such as materials, grading, smoothing, digging edge trench, applying back filling, etc., would have to be compared against similar costs for concrete, asphalt plank, or chemical lining treatment methods. Benefit factors in addition to seepage reduction must be fully considered; i.e., weed control, lightness of material for transporting to high elevations or remote pond sites, soil saturation, and water value for livestock, spraying, irrigation, household use, etc.

Some ponds are also used for collecting runoff water from furrow irrigation in conjunction with a return-flow system. There is an increasing interest in pollution control for streams, and some farms are collecting sewage within ponds for more complete digestion. It is desirable to prevent percolation of this sewage and an impermeable membrane is the cheapest way of preventing this. Pollution control, of course, will be important also for industrial applications. The University of California has developed a low-cost method for aeration of sewage wastes with the production of algae which they think may have some economic value for cattle feed.

Concentrating Runoff

Another use of plastic films that may have considerable impact on water conservation and development is in waterproofing watershed areas to collect and store limited rainfall. Sealed sheets of 8-mil black plastic are laid over a smoothed and formed collection area, the edges are buried, and the lower end is led into a storage pond or tank. Wind action is a major problem. Some success has been achieved with installation of wind-activated ventilators to create a negative pressure beneath the plastic, thus holding it close to the ground. Birds and animals have caused some physical damage under certain site conditions. In Hawaiian studies, attempts to protect the film with thin layers of soil or gravel have not been successful. The added surface area of this material increased the evaporative surfaces and reduced the collective efficiency. Further studies to improve stability under prolonged sunlight exposure and development of new methods of holding the film in place will advance this practice.

Reduction of Evaporation

To this point we have concentrated on water control and conservation in canals, ditches, ponds, and borders. Moisture conservation through reduction of evaporation from the soil surface by using plastic films to mulch various crops may be an even more important application for these materials.

Plastic film mulching has been done primarily with 1½-mil black polyethylene film, suitably pigmented, to provide durability and opacity for weed control. There has been sufficient experimental work with 1-mil film to show that this will be satisfactory for most crops, as soon as extruders make this thin-gage film available. One may expect still thinner films to be made in the near future as the technique for mulching improves and the mechanization has progressed, and as extruders improve their techniques. From the experimental studies conducted on very thin films, it appears that these may even be useful for very large areas of crops of low economic value. The future may bring forth a demand for these materials for crops presently considered uneconomical. Besides polyethylene, there also have been requests for sprayable compounds, and, although possible, it is believed that these sprays will be too costly to compete with the use of free film. The costs of solvents and the difficulty of getting continuous cover over a rough surface are the main deterrents.

The principal purposes for mulching are apparent. Water conservation is extremely important. Russell and Peters and other workers have reported that the water loss from soil by evapotranspiration can be reduced almost one-

Fig. 4 Peach trees are mulched with black polyethylene. Plastic reduces evaporation and controls weeds

Fig. 5 Strawberries mulched with black polyethylene are much cleaner than when grown with cultivation

half by the use of a film cover over the soil to prevent evaporation losses. By making soil moisture available for crop growth, it is sometimes feasible to grow crops without irrigation, even though precipitation may be low. Weed control is obtained by the use of an opaque black polyethylene film. Some weed penetration and damage by quackgrass and nutgrass has resulted when the film is applied taut over the soil. Most weeds have not caused any difficulty. Controlling weeds eliminates need for cultivation and also reduces the water requirement of the area. Reducing cultivation eliminates the problem of damaging roots of plants as in weeding. Soil compaction is reduced by fewer machine operations. Temperatures of soil under black polyethylene are somewhat higher than under other types of mulches—several degrees in the early spring and two or three degrees in the late summer. There is less temperature spread between morning and night under a plastic mulch than on a bare soil. Salt migration to the surface is reduced because of reduced evaporation at the soil surface.

Some surface mulches cause a deficiency of water from lack of profile recharge from normal rains. E. M. Emmert of Kentucky believes he has overcome this by using the film on a double ridge, planting the crop on the ridges, and making holes for water entrance in the furrow between the ridges. The water problem depends upon the soil type and whether the water moves vertically or has a tendency for lateral movement, the latter being preferred.

Although there have been variations with seasons, different planting techniques, and crops, crop response to mulching has been good with practically all crops. For example, at the Union Carbide Plastics Company research farm at Clayton, N. C., the 1959 yield increases with mulching were as follows:

Crop	Percent increase	Crop	Percent increase
Bush beans	27	Okra	27
Broccoli	30	Peppers (hot)	140
Cauliflower	97	Peppers (sweet)	85
Chrysanthemums	123	Potatoes	160
Cotton	149	Tobacco	34
Grapes	422		

Emmert reports an increased return of $625.00 per acre above costs of plastic mulching of Kentucky Wonder beans. Clarkson at Oregon State College reported yield increases of 60 percent in pole beans, 90 percent for tomatoes, and 300 percent for cantaloupes. Clarkson and Davidson further report that the cost for plastic to mulch an acre of watermelons at Hermiston, Oregon, was $87.12. The mulch produced 7.4 tons more melons per acre than non-mulched melons. At $20.00 per ton, this gave an additional gross income per acre of $148.00. Archie Fujimato, San Diego County, Calif., estimates a 75 percent reduction in ground rot losses on strawberries. Carolus at Michigan State University reports the yield of the first four pickings of summer squash was increased from 189 to 529 bu per acre by setting plants through film.

V. A. Clarkson, in an address before the American Society for Horticultural Science in February, 1959, made the following key statement in discussing plastic mulch responses: "Yield increases reported by various investigators using polyethylene as a mulch are not the result of the plastic material, but rather the influence of the plastic on soils, microclimate, and diseases." This statement has been well verified by a number of workers. Army and Hudspeth, working on grass germination, found that plastic mulches encouraged sufficient upward moisture migration to maintain the zero to one-half inch portion of the soil profile at near field capacity, thus facilitating germination. Slater and Broach report that the air under plastic covers is found to be close to 100 percent relative humidity. They also report on the light transmission of various types of plastics.

There seems to be little doubt that plastic mulch will be rapidly accepted as a standard production tool for high-priced crops where moisture, temperature, and weed control are essential to closely timed production schedules. For lower-value crops such as corn, cotton, tree fruits, etc., the production economics may become more important. However, it appears that the cost of 1-mil or thinner film is offset by the savings in cultivation costs, excess seed, irrigation, herbicides, and some fertilizer. Improved emergence can reduce the cost of thinning excess plants to allow for low germination, thus further offsetting film costs.

Emmert summarizes this cost by pointing out that, when film is billed at one-half cent per square foot, an acre can be covered for $200.00. With care the material can be reused for four years, thus giving a $50.00 annual charge. On wide-rowed crops only one-third or one-fourth of the area need be covered, which reduces the annual cost by $12.00 to $16.00.

The mechanization of placement of plastic film mulches is rapidly developing. There is need for a machine that can plant through plastic. There is also a need for a transplanter that will operate on a film-mulched area. Development of new types of fertilizer products may permit use of a plastic mulched area for several years without refertilization or other disturbance of the area except in planting through the stem slits.

SUMMARY

The possibilities for utilizing plastics to aid engineering progress in soil and water conservation are limitless. We have discussed but a few: drainage tubes, pond liners, ditch linings, mulching materials, levees, and borders, to review them briefly. Each application has been the result of an engineer comparing the requirements of a job with the "properties and capabilities of a material." Imaginative thinking, well-planned tests, and careful evaluation of the available materials provide the means of finding new, effective, efficient, and economical solutions to soil and water conservation engineering problems.

SOURCE MATERIAL

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. . . Energy Requirements for Pellets

(Continued from page 247)

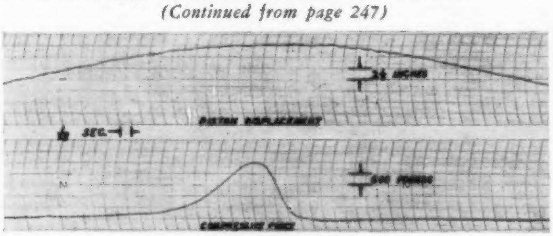

Fig. 17 Typical oscillograph tapes of piston force and displacement. (Time proceeds from left to right)

content alfalfa was compressed in the same size cylinder at approximately 3,500 psi (Table 1).

Similar comparison at 1,800 psi showed average pellet densities of 33.2 lb per cu ft compared to approximately 34 or 35 lb per cu ft in Butler's investigation.

The consistently lower pellet densities of this investigation, compared to densities of the previous test (3), can be attributed to shorter hold time of pressure application in this experiment. Pellets in the 1958 investigation (Butler) were made at a hold time of 5 sec. Average hold time in this investigation was about 1/25 sec, during which time the pelleting pressure increased from about 70 psi below maximum up to the peak pressure and back to 70 psi below the peak pressure (Fig. 17). An average time lapse of one second occurred between initial recorded pressure application and complete removal of pelleting pressure.

The relatively fine texture and high percentage of leaf content of the third-cutting alfalfa may also have been a factor affecting pellet densities in this investigation.

SUMMARY

A laboratory pelleting device was constructed to provide a means of measuring energy requirements for compressing whole hay for a short pressure-application hold time. The investigation was concerned with hay having a moisture content below 25 percent and with pelleting pressures of approximately 3,500 psi and lower.

Quantitative values, but not mathematical relationships, of energy requirements were obtained by strain gage measurements of force and displacement. Energy requirements for ejecting pellets from the closed-end cylinder were also measured.

Handling-durability tests were performed in order to determine pellet stability under simulated handling conditions.

CONCLUSIONS

The following conclusions are based on observations and data gained during the preliminary tests and during the actual investigation:

1 Third-cutting whole alfalfa hay was satisfactorily compressed at 4.6 percent moisture content (wet basis) to form pellets of 42 lb per cu ft density in a closed-end, 1.5-in. diameter cylinder at 3,500 psi.

2 Energy requirements for compressing hay increased with increased applied pressures and with decreasing moisture content values.

3 The hydraulic pressure-control device consumed as much as 2.8 hp-hr per ton of 4.6 percent moisture-content hay at 3,500 psi applied pressure.

4 Energy requirements for ejecting pellets from the chamber increased as pelleting pressure was increased, and decreased with increasing sample moisture contents.

5 Approximately 15 percent as much energy was required to eject pellets from the pelleting chamber as was required to compress them at 3,500 psi.

6 Maximum forces required to maintain motion of pellet ejection were greater than initial peak forces required to overcome static friction between pellets and chamber walls.

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. . . Tractor Engine Loading

(Continued from page 239)

Summary

A test tractor was instrumented to determine the engine power and speed requirements for 19 farm operations. Records were also obtained on the day-to-day-operation of 25 tractors. A combination of these data gave a picture of the total use of an average tractor. This information could be useful in the design of such items as carburetors and bearings.

This average tractor had a concentration of hours of use near maximum speed and maximum horsepower; however,

(Continued on page 252)

An Electrical Grade-Alignment Probe

Means for eliminating expensive exploratory excavation

V. S. Aronovici and W. W. Donnan
Affiliate ASAE Member ASAE

UNIFORM grade alignment of any type of lined or unlined mole drain is essential to its efficient operation. Much attention has been directed to the special design of mole-drain machinery equipped to maintain a uniform grade and capable of correcting for unevenness of ground surface and changes in soil resistance to the mole.

A means of evaluating grade alignment without expensive exploratory excavation is described in this report. The equipment described has been used successfully to check grade alignment in plastic-lined mole drain installations in California, Nevada, Utah and Colorado.

Instrument Design

The grade-alignment probe is essentially a mercury level. Electrical contacts establish the position of the mercury and transmit this information to a viewing panel. The level contains four fabricated parts: *(a)* The outer protective shell, 18 in. in length and 1⅝ in. in diameter, *(b)* the inner level tube, constructed of 1-in. diameter lucite tubing 15 in. long, *(c)* the rear connector plug, and *(d)* the forward bullet-nosed plug.

Fig. 1 presents a schematic drawing of the unit and the appurtenant circuitry of the signaling system. The tubular design allows for level readings without need for cross-section orientation; thus rotation will have no effect upon the grade observation.

The level is constructed of a 15-in. lucite cylinder, 1 in. O.D. with ⅛-in. wall thickness. The ends are sealed with lucite plugs onto which are cemented washer-shaped stainless steel electrodes. The forward plug is tapped with ¼-in. machine threads to receive a threaded stopper, and a thin neoprene washer prevents any possible air or mercury leaks. This provides an opening for filling and cleaning the cylinder. Round-headed SAE 4-40 stainless steel ¼-in. machine screws are placed in 12 banks of six each, 1½ in. in from the ends and at 1-in. intervals the length of the tube. The lucite tubing is tapped to receive the screws. The end of each screw is carefully polished and rounded so that a smooth surface projects very slightly above the inside wall of the lucite cylinder.

Electrodes of each set are wired to a single lead and secured to the inside terminal of a Cannon connector. The level is carefully wrapped with plastic electrical tape to insulate the screw heads and to protect and hold the lead wires in position. The level tube unit, with the rear plug containing the Cannon connector attached, is slid into the outer core and secured in position with flush Allen screws. The forward bullet-shaped head is then slipped into position and held in place by six more flush Allen screws. These two plugs hold the level firmly in position.

Just prior to assembly, five ounces of clean mercury are poured into the level, although this quantity may vary slightly. The mercury should just contact all electrodes when the instrument is in level position. If facilities are available, the cylinder should then be evacuated of air and replaced with a non-corrosive gas such as nitrogen. This will help reduce the rate of oxidation of the mercury and consequently require less maintenance. Considerable care must be exercised in preventing oxidized mercury from accumulating on the surface, as this will cause sluggish activation and breaking of contacts, resulting in reduced sensitivity.

After the alignment probe is assembled and a 14-wire cable attached to the Cannon connector at the rear of the level, all fitting joints are lightly brushed with heated well driller's wax to prevent moisture from leaking into the core. A 20-gauge, 14-wire rubber or neoprene-covered cable connects the alignment probe to the observation panel.

Observation Panel

The observation panel is built into a conventional metal radio circuit box (Fig. 1). A bank of 14 small 6 or 8-v ac or dc lights are mounted behind the same number of jeweled light reflectors. For convenience the "F" light may be red, the "R" light blue and level electrodes white. A three-way switch and an appropriate rheostat complete the installations.

A portable 115-v ac generator provided the power for the unit described and the observation box was powered by a heavy-duty 115-v to 12-v ac transformer. Individual light shielding provides better visibility. The rheostat is used to raise and lower voltage as desired. This will depend upon the resistance of the cable and power source used. For example, a 20-gage annealed copper wire has 1.015 ohms

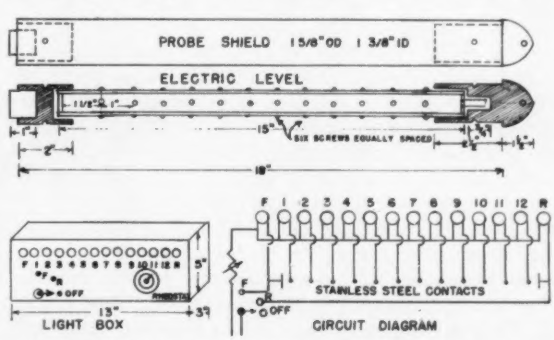

Fig. 1 Schematic plan of electric grade-alignment probe

An Instrument News Contribution from the Soil and Water Conservation Research Division (ARS) USDA. Articles on agricultural applications of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

The authors — V. S. Aronovici and W. W. Donnan — are, respectively, soil scientist and drainage engineer, Southwest Branch, Soil and Water Conservation Research Division (ARS), USDA, Pomona, Calif.

. . . An Electrical Grade-Alignment Probe

resistance per 100 ft of cable. This will result in a voltage drop of 2.5 v in a 2.5 amp system. Thus it is possible to obtain maximum light intensities without burning out the bulbs when using either a long or short cable.

Calibration

The instrument must be calibrated with the light signal box after each mercury filling and prior to use in the field. As the level is moved from a horizontal position, lights from left to right or right to left will begin to go out. A plot can be made with the slope in degrees or percent on the ordinant axis and the abscissae scale will indicate the last light remaining on. For example, if the level is tilted forward 5 deg and the F electrode is turned on, lights 1 to 10 will remain on while lights 11 and 12 will go out. Thus, light number 10 is the last light to remain on. Fig. 2 illustrates a calibration curve.

Calibration requires a simple level mount which can be referenced accurately to an angle of slope. Such a device can be easily constructed of a 1/16-in. sheet metal arm 20 in. in length and 3 in. wide, hinged to a slightly longer metal plate. A thumbscrew threaded through the unhinged end of the arm raises the arm from a level position. A large protractor measures the angle of deflection from level. The angle may be computed by measuring elevation from the base plate at the end of the arm, and a large carpenter's level can be used to check the level of the base plate. Two U bolts secure the level to the movable arm. Calibration should be done in both forward and rear sloping positions. By checking angle changes with the number of turns of the thumbscrew, desired angles may quickly be obtained and permanently referenced. Calibration may be accomplished by means of a large surveyor's transit or other device in which the angle of declination may be accurately observed.

Sensitivity

Sensitivity depends upon the condition of the mercury, as stated above. Sensitivity may also be increased by lengthening the level. A compromise between practical limits of length, number of electrodes and electrode intervals suggests the present design. It is possible to detect with good reliability grades from 2.5 to 10 deg.

Field Use

Grade-alignment exploration is necessarily confined to drains which were prepared for future inspection at the time of installation. This includes installation of an inspection box at the head of the drain and placing of 20-gage stainless steel wire in the drain. This wire facilitates drawing 1/16-in. preformed stainless steel cable into the line and pulling the grade-alignment level through.

Calibration completed, the level is connected to the pull cable at the outlet of the drain. The electric cable is connected to the Cannon connector in the rear of the level and to the signal box. The level is then pulled forward in short increments while the current is turned off. When forward motion has stopped, the current is turned on and an observation obtained. Spacing of observations will depend upon conditions as they are found. For example, more observations are desirable near the outlet of the drain than in uniform reaches. Abrupt changes in soil structure and texture should receive special attention. Field observations with this level have revealed that erratic grade alignment frequently occurs near the outlet of the drain. The results have shown a reverse grade between 5 and 15 ft from the outlet but beyond this point the grade tends to be reasonably uniform.

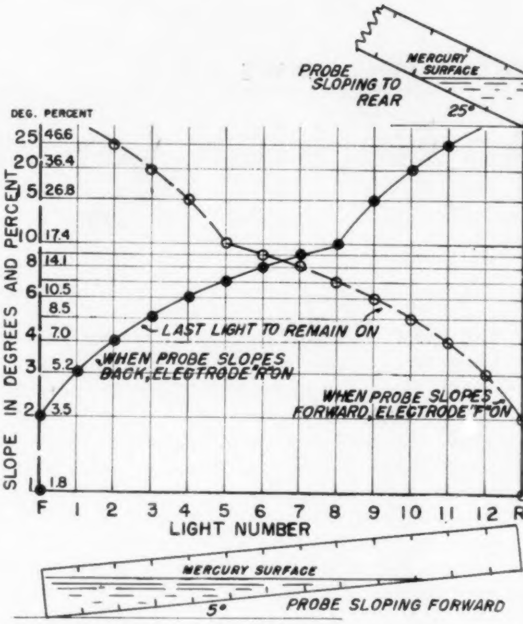

Fig. 2 Calibration curve for the electric grade-alignment probe

Summary

A simple instrument for the observation of mole drain grade alignment is described. All materials are easily obtainable and fabrication requires but moderate shop facilities and machining skill. The level has proved to be a useful diagnostic tool by revealing both good and unsatisfactory grade alignment after installation.

. . . Tractor Engine Loading

(Continued from page 250)

it was also used a considerable portion of the time at part load. Average load for this tractor was 54.7 percent of full horsepower, and average fuel consumption per hour for a year corresponded to the third line of Nebraska Test E. Average use per year for the 25 tractors was only 340 hours.

It was not possible to include all of the results of the study in this article. More complete details are given in the author's thesis (6).

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Elvin F. Henry *(left)*, ASAE member and soil scientist with the Federal Housing Administration, is the first employee to receive an Outstanding Performance Award in the agency's Office of Technical Standards. The presentation was made on the basis of the important contributions he has made to the agency. He guided the development of the FHA potential volume change meter used to test the expansiveness of soils. In addition, he was instrumental in FHA's adopting a uniform system for identifying soils in residential developments. Mr. Henry was presented with a check for $250 in recognition of his services. Award was made by A. W. Jarchow *(right)*, acting assistant commissioner for Technical Standards

ASAE Cultural Practices Equipment Committee Meets

The ASAE Power and Machinery Division's Cultural Practices Equipment Committee met March 22 at the LaSalle Hotel, Chicago. A total of 40 persons, representing industry and public service organizations, attended this special meeting of the committee. The following four major area interests were covered: (1) A review of research at the various experiment stations throughout the country; (2) research techniques employed at these various locations; (3) extension activities in this field; and (4) an opportunity for industry questions and comments concerning the program.

Change in Department Head at Rutgers University

The appointment of Mark E. Singley as chairman of the agricultural engineering department at Rutgers – The State University has been announced recently. He succeeds Harry E. Besley, who relinquished the chairmanship voluntarily because of the pressure of other duties. Mr. Besley will continue as an active member of the department in the position of superintendent of plant and equipment, farm department, College of Agriculture.

Mr. Singley was born in 1921 at Delano, Pa. He received a B.S. degree in agricultural engineering in 1942 from the Pennsylvania State University, and an M.S. degree with a major in agricultural engineering in 1949 from Rutgers University. He spent four years (1942-46) in the U.S. Navy and one year as deputy zone employment officer in Germany, in rehabilitation of displaced persons through employment on engineering projects. In 1947 he joined the agricultural engineering department at Rutgers as an instructor. He was promoted to assistant professor of agricultural engineering in 1949; to associate professor in 1953; and to professor in 1957. He has been an ASAE member since 1947, and has been active in agricultural research. His studies have included crop conditioning and storage, flow of agricultural materials, the development of self-feeder structures, and the mechanization of fruit and vegetable harvesting.

Oregon State College Now State University

A report has been received that effective March 6 the name of Oregon State College was changed to Oregon State University.

Crop Dryer Meeting

The FEI Crop Dryer Manufacturers Council combined the agricultural talents of Purdue University and Iowa State University at its annual spring meeting, May 15 and 16, held on the Purdue campus. The presentations centered around solving the problem of maintaining the proper balance and quality in drying grain by further advancing the performance of crop drying equipment. ASAE members who participated in the program were G. W. Isaacs, G. H. Foster, R. A. Thompson, G. L. Zachariah and B. A. McKenzie from Purdue University; and W. V. Hukill and R. A. Saul from Iowa State University.

European Farm Building Publication

The European Documentation Centre for Farm Buildings, Lund, Sweden, has announced publication of the documentary and informative bulletin *Agricultura* issued twice a year. The new publication is printed in English, French, German, and Swedish and is priced at $1.50 per copy or $2.00 for both numbers. Published material will be furnished by contact men or reporters from 19 European countries and will consist of brief abstracts of test results or original dissertations, to the extent the reporters consider that the publication should be done more completely than in a brief abstract.

Copies may be obtained from A. Orborn, Statens Forksningsanstalt for Lantmannabyggnader, Lund, Sweden.

National Farm Fire Safety Seminar

ASAE members M. L. Esmay, professor of agricultural engineering, Michigan State University; K. V. D. Fiske, superintendent, research farm, Velsicol Chemical Corp., Woodstock, Ill.; and R. E. Heston, director of engineering, Farmers Mutual Reinsurance Co., Grinnell, Iowa, will participate in the National Farm Fire Safety Seminar, to be held on July 19 and 20 at the Thor Research Center for Better Farm Living, Huntley, Ill. "Fire Safety on the Farm" will be the

Seminar subject and will include workshops on rural fire statistics; problems of structures and equipment; private farm inspection programs; safeguarding farms against fires; and rural fire departments.

Farm Mechanization Conference

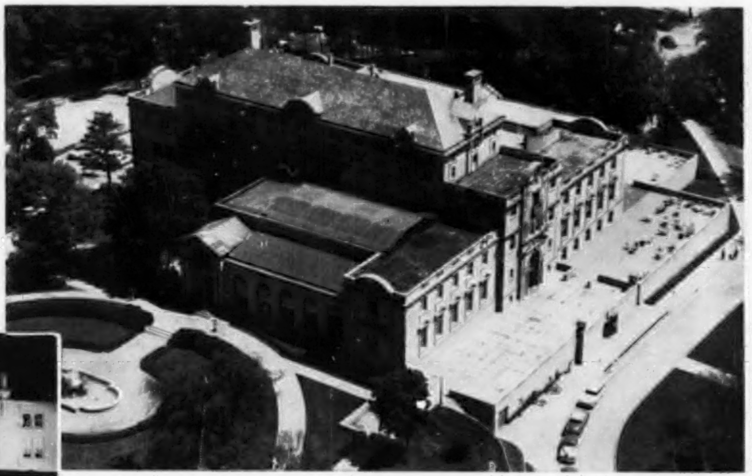
The Federation of Rhodesia and Nyasaland held its first Farm Mechanization Conference at the University College of Rhodesia and Nyasaland in Salisbury on May 9 to 11. It was sponsored by the Federal Ministry of Agriculture, the Rhodesia National Farmers' Union, the Agricultural and Earth Moving Machinery Importers' Association of Rhodesia and Nyasaland, and the University College of Rhodesia and Nyasaland. The Conference served the purpose of allowing Rhodesian farmers to put forward their views of how mechanization will proceed during the next five or ten years, so that the machinery trade and the government departments can plan their operations. The main speaker was J. A. Vorster, director, Agricultural Mechanization and Engineering Division, Department of Agricultural Technical Services, South African Government, Pretoria. H. A. Templeton, an ASAE member and farm machinery engineer, Federal Department of Conservation and Extension, Rhodesia, was a member of the Organizing Committee for the conference.

BRI Spring Conferences

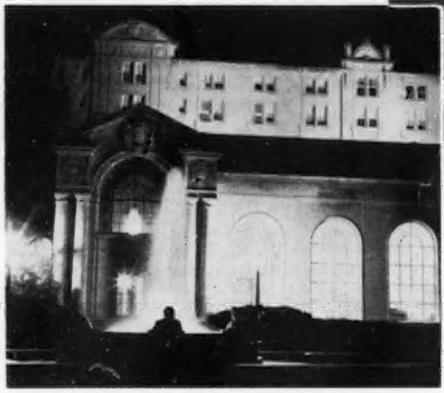
The Building Research Institute's Planning Committee on Adhesives and Sealants in Building presented Spring Conferences May 16 to 18 at the Shoreham Hotel, Washington, D. C. During the three-day conference period the following subjects were scheduled: Requirements for weatherproofing thin shell concrete roofs; pressure sensitive tapes for building; selection and field application of adhesives; reports of a

(Continued on page 257)

ASAE President L. W. Hurlbut *(left)* describes the equipment and procedures used in testing tractors for the Nebraska Tractor Tests. Interested listeners are left to right: A. W. Cooper, director, USDA National Tillage Machinery Laboratory, Auburn, Ala.; J. L. Butt, ASAE executive secretary; and W. R. Gill, soil scientist, USDA National Tillage Machinery Laboratory. This foursome met with Nebraska agricultural engineers and then drove to Laramie, Wyo., to attend the ASAE Rocky Mountain Section meeting held on April 14 and 15



THE ISU Memorial Union *(Right)* will serve as Headquarters for the 1961 ASAE convention. Below is shown a mid-summer night view of the Memorial Union fountain



Iowa State University is Site of 54th Annual Meeting

June 25 - 28

THE 54th Annual Meeting of ASAE will be held June 25-28 at the Iowa State University campus in Ames. In addition to the technical programs, Iowa Section members have arranged for family activities, as well as special functions for women and children during the four-day meeting.

The Sunday evening buffet dinner and entertainment, to be held in the Memorial Union ballrooms, will open the special events Other special-activity highlights will be the Student Breakfast on Monday morning at Friley Hall; the Chicken Barbecue on Monday evening on the lawn west of the Armory, followed by a Square Dance in the Armory; the FEI Student Dinner on Tuesday evening; the tours scheduled for Wednesday afternoon; and the Annual Banquet and presentation of awards followed by dancing on Wednesday evening.

Iowa is the only state in the nation bounded by two major navigable rivers. Rivers, lakes, hills and valleys, as natural vacation attractions, may be added to man-made structures such as covered bridges, water-wheel-driven grist mills, the Little Brown Church in the Vale, the Grotto of the Redemption and many others to make Iowa truly a "vacation haven in mid-nation"

Lake LaVerne, surrounded by trees, shrubs and flowers, is a campus landmark and a favorite lounging spot between classes

ORVILLE L. FREEMAN
Secretary of Agriculture

The Honorable Orville L. Freeman, Secretary of Agriculture, and Frank H. Hamlin, president of Papec Machine Co. of Shortsville, N. Y., will be featured speakers at the General Session to be held Tuesday, June 27, during the 54th Annual Meeting of ASAE at Iowa State University. The 43-year-old Secretary, who served three terms as governor of Minnesota before being appointed to President Kennedy's cabinet, will speak on "New Frontiers". Mr. Hamlin, who has been a member of ASAE since 1932, will discuss the tie between industry and agriculture in his speech, "Partners"

FRANK H. HAMLIN

Business Meeting and General Session

The annual business meeting will be held Tuesday morning, June 27, at which the winning paper in the ASAE Student Paper Award competition will be presented. A General Session will follow the business meeting at which the featured speakers will be the Honorable Orville L. Freeman, Secretary of Agriculture, and Frank H. Hamlin, president, Papec Machine Co., Shortsville, N. Y. Secretary Freeman will speak on the subject "New Frontiers," while the title of Mr. Hamlin's address will be "Partners". Also a highlight of this session will be the address entitled "Agriculture, Engineering and You" by ASAE President L. W. Hurlbut, chairman, agricultural engineering department, University of Nebraska.

Technical Sessions

The Power and Machinery Division will hold eight concurrent sessions during the four-day meeting period. Both the Soil and Water and Electric Power and Processing Divisions each will hold five sessions, while the Farm Structures Division will hold three sessions.

Special Programs

In addition to the student breakfast on Monday morning, the Student Branches will have a program on Tuesday morning, plus the FEI dinner for students Tuesday evening. The Extension program will be held on Monday morning, and the Personnel Service Contact Session on Monday afternoon. The Public Land and Public Works groups will hold sessions on Tuesday and Wednesday afternoons.

Exhibits

Extension Exhibit entries in the following specific classes will be set up in the Music Room of the Memorial Union: Publications; Demonstration Models and Instructive Exhibits; Movie; Radio and Television; Slides; and Extension Methods and Recipes.

Registration

The local arrangements committee has advised that mail registration before June 5 will save early registrants one dollar handling fee. Those who register early and request on-campus housing may check in directly at the assigned dormitory where they will receive a complete convention packet. Those registering late or staying off-campus will pick up convention kits at Headquarters in the Memorial Union.

Weather Bulletin

State Climatologist Paul Waite says the probability of good weather for the meeting is "excellent". His climatic record check for June 25-28 shows: Average daily maximum temperature — 63 degrees; sunshine more than two-thirds of the daylight hours; the probability of one light afternoon shower (less than 0.2 of an inch); and a prevailing southerly wind of 10 to 15 mph. He reports that the last of June is one of the ideal times in Iowa, weatherwise.

This Alcoa (Aluminum Co. of America) plant at Bettendorf houses the world's largest aluminum rolling mill. It is reported that currently 75 of the nation's top 500 industries have plants in Iowa and that manufacturing income is now well over twice Iowa's high-ranking agricultural income

Quad City Section

A total of 222 members and guests attended the annual meeting of the Quad City Section on April 21 in Davenport, Iowa. Plant tours through the John Deere Industrial Equipment Works in Moline and the French and Hecht Division of Kelsey-Hayes Co., Davenport, preceded the afternoon technical session at the Blackhawk Hotel. The speaker for the afternon program was R. D. Drushella of the research division of Allis-Chalmers Manufacturing Co. He related the progress on the development of the fuel cell. L. W. Davis, vice-president and general manager of the farm equipment division of Allis-Chalmers Manufacturing Co., was the featured dinner speaker in the evening. In his address, entitled "A Better Mousetrap—But Whose?", he explained how sales management views the role of the agricultural engineer.

The following new officers for 1961-62 were elected at this meeting: W. M. Adams, chairman; V. W. Thede, vice-chairman; D. E. Burrough, vice-chairman; M. W. Forth, secretary; R. B. Skromme, treasurer; and J. W. Ackley, chairman of nominating committee.

Iowa Section

The Iowa Section held a dinner meeting on April 21 at the McNeal Hi-Way Hotel in Des Moines, Iowa. The program following the business meeting included discussions on farmers and farm chemical application by C. M. Berry, associate director, Institute of Agricultural Medicine, University of Iowa, and trends in hydraulics on mobile equipment, by C. L. Callum, product engineer, John Deere Industrial Equipment Works, Moline, Ill.

Central Illinois Section

The Central Illinois Section held its spring meeting on May 6 at the Agricultural Engineering Building, University of Illinois, Urbana. Guests for the day were high school students interested in agricultural engineering. The morning program consisted of a discussion of selected research projects, including pneumatic conveying of feed and grain; testing lumber rigid frames; soil and water laboratory; rapid high-temperature corn drier; new dynamometer demonstration; and high-pressure injection of liquid fertilizer. In line with the program theme of informing the guests about agricultural engineering, the session following the noon luncheon included the viewpoints of practicing agricultural engineers and a student in agricultural engineering on "My Career as an Agricultural Engineer." "The Future of Agricultural Engineering" was the topic of Section Chairman K. E. Fuller's talk, which concluded the program.

Hawaii Section

Thirty-two members and guests attended the Hawaii Section dinner meeting held on March 3 in the meeting house of the Princess Kaiulani Hotel. B. D. van't Woudt spoke to the group on his recently completed trip around the world. His presentation also included slides of irrigation systems throughout the world, particularly Russia, and some very beautiful and picturesque city and rural scenes. The following officers were elected for the year 1961-62: E. P. Morgan, chairman; J. K. Wang, first vice-chairman; D. F. Janssen, second vice-chairman; and C. B. Holtwick, secretary-treasurer.

Michigan Section

The Michigan Section held its winter meeting on February 25 at Northland auditorium in Detroit. In spite of poor weather attendance was good with a registration of 90. The morning session included a presentation by Earl Fenton, Michigan Watershed Protection Planning Party, on watershed development; one by P. J. Campbell, Tractor and Implement Division, Ford Motor Co., on the subject "A Product Design Engineer — What Does He Do?"; and one by H. H. Carlson, Vickers, Inc., on mobile hydraulic systems filtration. Following the noon luncheon a movie entitled "An Equation for Progress" was viewed. G. C. Blomquist, civil engineering department, Michigan State University, addressed the group concerning professional representation. The program concluded with a panel discussion on row spacing — 1970. C. M. Hansen, agricultural engineering department, MSU, participated as moderator, and members of the panel were: L. V. Nelson, farm crops department, MSU; L. S. Robertson, soil science department, MSU; W. H. Johnson, agricultural engineering department, Ohio State University; and L. A. Warschefsky, county extension director, Huron County, Mich.

ASAE MEETINGS CALENDAR

May 18-20 — FLORIDA SECTION, Daytona Plaza Hotel, Daytona Beach, Fla.

May 20 — SOUTHERN CHAPTER, PACIFIC COAST SECTION, California State Polytechnic College, San Luis Obispo.

May 23 — NORTHERN CHAPTER, PACIFIC COAST SECTION, Hotel Covell, Modesto, Calif.

May 24 — CONNECTICUT VALLEY SECTION, Publick House, Sturbridge, Mass.

May 29 — BATON ROUGE SECTION, Agricultural Engineering Auditorium, Louisiana State University, Baton Rouge.

June 25-28—ANNUAL MEETING, Iowa State University, Ames, Ia.

August 20-23—NORTH ATLANTIC SECTION, University of New Brunswick, Fredericton, N. B., Canada.

October 18-20 — PACIFIC NORTHWEST SECTION, Boise Hotel, Boise, Idaho.

December 12-15 — WINTER MEETING, Palmer House, Chicago, Ill.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

Alabama Section

During its spring meeting on April 20 and 21, the Alabama Section elected the following officers for 1961-62: F. M. Gambrell, chairman; E. S. Renoll, vice-chairman; and B. Y. Richardson, secretary-treasurer.

West Virginia Section

Officers elected to serve the West Virginia Section for 1961-62, at its meeting on April 21, are as follows: R. A. Phillips, chairman; J. D. Bane, vice-chairman; H. L. Ridder, secretary-treasurer; A. D. Longhouse, councilor, and J. L. Dove, councilor.

(Continued on page 258)

The Quad City Section held its annual meeting on April 21 at the Blackhawk Hotel in Davenport, Iowa, with a total of 222 members and guests in attendance. *(Above)* R. G. Morgan, retiring chairman, greets the incoming officers for the year 1961-62: *(Left to right)* Morgan, W. M. Adams, chairman; V. W. Thede, vice-chairman; D. E. Burrough, vice-chairman; M. W. Forth, secretary; R. B. Skromme, treasurer; and J. W. Ackley, chairman of the nominating committee. *(Right)* L. W. Davis, vice-president and general manager of the farm equipment division of Allis-Chalmers Manufacturing Co., addresses the group at the annual dinner on the topic "A Better Mousetrap—But Whose?" Seated left to right are: J. L. Butt, executive secretary of ASAE; R. G. Morgan, retiring Section chairman; and Harman Mulbar, public relations and advertising manager, ASAE.

. . . News

(Continued from page 253)

workshop on weatherproofing thin shell concrete roofs; plastics in building — intersociety activity reports; public entrance doors; and reports on new research and suggestions for further study.

AE in Canadian Publication

The Spring 1961 issue of *Esso Farm News*, house organ of Imperial Oil Limited, Toronto, Canada, carries an excellent article entitled "Agricultural Engineers Look Ahead," which comments on the topics covered during the ASAE 1960 Winter Meeting in Memphis, Tenn.

ASEE Elects New Officers

Robert W. Van Houten, president, Newark College of Engineering and director, Newark Technical School, was elected recently to serve the American Society for Engineering Education as president for 1961-62. Elected as vice-presidents are George A. Marston, dean of engineering, University of Massachusetts, and Curtis L. Wilson, dean of the Missouri School of Mines and Metallurgy. Wendel W. Burton, Minnesota Mining and Manufacturing Co., returns to the post of treasurer.

New Standard for the Storage and Handling of Anhydrous Ammonia

Word has been received from Douglas Johnston, ASAE representative on the American Standards Association Sectional Committee K61, that a new standard "American Standard Safety Requirements for the Storage and Handling of Anhydrous Ammonia" has been completed. Copies may be obtained from American Standards Association, Inc., 70 E. 45th St., New York 17, N. Y., or Compressed Gas Association, 420 Lexington Ave., New York 17, N. Y.

EVENTS CALENDAR

May 16-18 — *Building Research Institute Spring Conference,* Shoreham Hotel, Washington, D.C. Details may be obtained from BRI, 2101 Constitution Ave., N.W., Washington 25, D.C.

May 22-25 — *Design Engineering Show,* Cobo Hall, Detroit, Mich. Information may be obtained from: Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

May 23 — *Farm Equipment Institute, Production and Marketing Department,* Hotel Pfister, Milwaukee, Wis. Write to FEI, 608 S. Dearborn St., Chicago 5, Ill., for information.

June — *First International Conference on the Mechanics of Soil-Vehicle Systems,* Turin, Italy. For further information write to: M. G. Bekker, national secretary for the Conference, U.S. Army Ordnance Tank-Automotive Command, 1501 Beard, Detroit 9, Mich.

June 9-17 — *European Congress of Chemical Engineering and ACHEMA Congress,* Frankfurt am Main. Information is available from DECHEMA, Frankfurt am Main 7, Postfach.

June 11-15 — *American Society of Mechanical Engineers Summer Annual Meeting,* Statler-Hilton Hotel, Los Angeles, Calif. Contact ASME headquarters, 29 W. 39th St., New York 18, N. Y., for information.

June 11-23 — *Solid State Mechanics Short Course,* The Pennsylvania State University, University Park, Pa. Further information may be obtained from Conference Center, Pennsylvania State University, University Park, Pa.

June 12-16 — *First International Conference on Mechanics of Soil-Vehicle Systems,* Turin Institute of Technology, Torino, St. Vincent, Italy. Information may be obtained from M. G. Bekker, Defense Systems Division, General Motors Corp., GM Technical Center, Warren, Mich.

June 25-30 — *American Society for Testing Materials Annual Meeting,* Chalfonte-Haddon Hall, Atlantic City, N. J. Write to ASTM headquarters, 1916 Race St., Philadelphia 3, Pa., for information.

June 26-30 — *Annual Meeting American Society of Engineering Education,* University of Kentucky, Lexington. Details may be obtained from ASEE headquarters, University of Illinois, Urbana.

July 4-7 — *27th Annual Meeting of The National Society of Professional Engineers,* Olympic Hotel, Seattle, Wash. Details may be obtained from NSPE headquarters, 2029 K St., N.W., Washington 6, D. C.

July 10-14 — *Institute in Technical and Industrial Communications,* Colorado State University, Fort Collins. Contact the Director, ITIC, Colorado State University, Fort Collins.

July 19-20 — *National Farm Fire Safety Seminar,* Thor Research Center for Better Farm Living, Huntley, Ill. Write to Thor Power Tool Co. for information.

July 23-29 — *National Farm Safety Week.*

July 30-August 2 — *16th Annual Meeting, Soil Conservation Society of America,* Purdue University, West Lafayette, Ind. Further information may be obtained from SCSA headquarters, 838 Fifth Ave., Des Moines, Iowa.

August 1 – September 12 — *International Course on Irrigation, Subtropical Regions,* Irrigation Extension Centre of the Ministry of Agriculture, Ruppin Institute of Agriculture, Emek-Hefer, Israel. Information may be obtained by writing to J. Noy, director, Ministry of Agriculture, Irrigation Extension Center, Post Hamidrasha, Le'Haklaut, Emek-Hefer, Israel.

August 14-17 — *50th Annual Convention, International Association of Milk and Food Sanitarians,* Wanderer Resort Motel, Jekyll Island, Ga. Write to T. L. Jones, Room 512, 1145 19th St., N. W., Washington 6, D. C., for information.

September 5 - 8 — *11th National Chemical Exposition,* sponsored by the Chicago Section, American Chemical Society, International Amphitheatre, Chicago, Ill. Further information may be obtained from The Chicago Section of the American Chemical Society, 86 E. Randolph St., Chicago 1, Ill.

September 6-8 — *Seventh Midwest Conference of Fluid Mechanics and Solid Mechanics,* Kellogg Center for Continuing Education, Michigan State University, East Lansing. Address inquiries concerning the conference to: Conference Publicity Committee, c/o J. E. Lay, Department of Mechanical Engineering, MSU, East Lansing, Mich.

September 10-13 — *68th Annual Farm Equipment Institute Convention,* Palmer House, Chicago, Ill. For details contact FEI, 608 S. Dearborn St., Chicago 5, Ill.

September 25-28 — *Industrial Building Exposition and Congress,* New York Coliseum, New York, N. Y. Contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. for details.

October 19 — *Fifth International Course in Hydraulic Engineering,* Delft, Netherlands (for eleven months). Information may be obtained from Netherlands Universities Foundation for International Co-Operation, 27 Molenstraat, The Hague, Netherlands.

October 20-22 — *Eastern Lawn and Garden Trade Show,* New York Coliseum, New York, N. Y. Write to ELGTS, Suite 1103, 331 Madison Ave., New York 17, N. Y., for information.

October 22-27 — *Dairy Industries Supply Association, International Association of Ice Cream Manufacturers, and Milk Industry Foundation Conventions,* Washington, D. C. For further details contact T. L. Jones, Room 512, 1145 19th St., N.W., Washington 6, D. C.

. . . ASAE Council Action

(Continued from page 235)

Following reports from the various steering committees by respective councilors, the following action resulted: Suggested changes in the ASAE "Standards for Design and Installation of Non-Reinforced Concrete Irrigation Pipe Systems," which were presented previously by mail, were approved. Co-sponsorship by ASAE of "Review of Soil-Water Research" with the American Society of Civil Engineers, provided a suitable sponsor could be found, was authorized. A recomendation was made to carry in the Yearbook the procedure followed in selecting papers for programs and publications. After discussion it was decided that the major responsibility for the General Session at the Winter Meeting should remain with the Education and Research Division. A discussion of Society policy concerning the appointment, by the Local Arrangement Committee chairman for the summer meeting, of a Meetings Committee chairman to function for the entire year resulted in a proposal to refer the matter to the headquarters staff, which was asked to present a recommendation concerning appointment of a Meetings Committee chairman for consideration by Council at the June meeting.

It was reported that a geographical organizational pattern for the Society to include regional sections, state sections, and local chapters is being considered by the Forward Planning Committee. Membership for executives and administrators was discussed and it was agreed that establishing additional member grades by the addition of qualifying adjectives was undesirable. It was, however, favorable to the idea of according the Member grade, without qualification, to applicants who are executives or administrators supervising the work of engineers.

Society members having pertinent comments concerning any of these actions are encouraged to submit them directly to members of the ASAE Council shown on table of contents page of this issue, or to the executive secretary of ASAE.

. . . With ASAE Sections

(*Continued from page 256*)

The Acadia Section (a sub-section of the North Atlantic Section) held its organizational meeting on April 5 on the campus of the University of Maine. *(Above)* Newly elected Section officers are: *(Left to right)* F. R. Bailey, past-chairman; B. L. Bondurant, chairman; J. A. Roberts, chairman-elect; R. H. Stone, vice-chairman; and C. M. Milne, secretary-treasurer. *(Left)* Participating in a panel discussion on agricultural engineering in tomorrow's agriculture during the meeting are left to right: H. N. Stapleton, M. E. Singley, and R. O. Martin

Acadia Section

An organizational meeting of a new sub-section of the North Atlantic Section, to be known as Acadia, was held on April 5 on the campus of the University of Maine, in conjunction with the University's annual Farm and Home Week. This new section will bring together in closer alliance agricultural engineers of Maine and the Canadian maritime provinces of New Brunswick, Nova Scotia, and Prince Edward Island. It is pointed out that although at the present time agricultural engineers in the Acadia Section are relatively few and scattered throughout its widespread territory, they face many common problems in their service to agriculture. Opportunities exist for contributions to the farming people of the region, the agricultural engineering profession, and the development of individual agricultural engineers. It was felt that the best possibility for such progress existed in an organization such as the Acadia Section, which brings to 31 the number of ASAE sections.

The following officers were elected for the first year: B. L. Bondurant, chairman; J. A. Roberts, chairman-elect; R. H. Stone, vice-chairman; and C. M. Milne, secretary-treasurer. To provide a complete executive committee for the first year, F. R. Bailey was elected past-chairman. A highlight of the meeting was a discussion on agricultural engineering in tomorrow's agriculture, led by R. O. Martin, agricultural engineer, H. P. Hood & Sons, Boston, Mass.; M. E. Singley, professor of agricultural engineering at Rutgers University; and H. N. Stapleton, agricultural engineer, Shelburne Farms, Shelburne, Vt. Up for scrutiny were such varied subjects as the objectives of professional curricula; the need for greater understanding of the role of farm structures in agricultural production; and the necessity for multiplying the efforts of engineers by moving, whenever possible, from custom-built to packaged structures and related equipment.

Washington, D.C.-Maryland Section

The Washington, D.C.-Maryland Section held a meeting on April 14 in the USDA South Building. The total attendance was 46, including approximately 10 guests. Among these were C. A. Bennett, now retired and formerly with the USDA Agricultural Research Service, and several agricultural representatives from the Embassies. These included Haiti, Ghana, UAR, Mexico, Australia, South Korea, Indonesia, and Great Britain. Henry Edmunds, agricultural attache, British Embassy, Washington, D.C., gave his impressions of American agriculture as viewed through British eyes. His comments were very interesting and enlightening on the differences in acreages, stocking rates, and complexity and concentration of production between the two countries. He made a particular point of the presence of a potential capability here to expand production to far beyond that now producing our present surpluses. Acknowledging the trend toward mechanization and increased unit output, he cautioned against "forgetting" the small operator who may lack capital to mechanize or who may mechanize only partially and then find himself without sufficient manual labor to handle his unmechanized operations. During the business meeting the following officers for 1961-62 were elected: R. L. Green, chairman; G. C. Winter, vice-chairman; and J. W. Rockey, secretary-treasurer.

South Carolina Section

The South Carolina Section held its winter meeting on March 9 and 10 at Clemson College. There were 51 present, including 12 students and 4 visitors. The program included two tours. Charles A. Jackson, resident engineer, Corps of Engineers, gave a briefing and conducted a tour of the Clemson College Protective Works, and George H. Dunkelberg, agricultural engineer, and John S. Evans, head of farms department, Clemson College, gave a briefing and conducted a tour of the Simpson Experiment Station. Also featured on the program were E. P. Glasscock of the South Carolina Electric and Gas Co., who spoke on the subject "Electric Power and Processing," and F. C. Landrum, who explained the construction and operation of the new line of John Deere tractors. Clemson House was the place of the annual banquet, where members and their ladies were entertained by Carl Stender of the South Carolina Department of Agriculture.

Connecticut Valley Section

The Connecticut Valley Section will hold a meeting on May 24 at which the ladies will be special guests. As mentioned by Section Secretary Thomas Stone, "Give your girl time off to come with you and enjoy a fine program." An afternoon tour of the Quabbin Reservoir at Belchertown, Mass., will precede the evening dinner meeting and program, at Publick House, Sturbridge, Mass. Zimri Mills, state conservation engineer, Amherst, Mass., will be the featured speaker of the evening, addressing the group on watershed protection programming.

A program planning meeting of the North Atlantic Section was held recently in the New England Electric System office in Boston, Mass. Plans were made to hold the Section's 1961 annual meeting on August 20 to 23 at the University of New Brunswick, Fredericton, New Brunswick, Canada. Those attending are from left to right: M. M. Weaver, program chairman (SW); H. E. Gulvin, secretary-treasurer; E. C. Schneider, program chairman (FS); N. T. Brenner, Section chairman; A. G. Fox, Jr., program chairman (EPP); H. W. Kitching, program chairman (PM); J. A. Roberts, local arrangements chairman; and O. C. French, Section past-chairman.


W. J. Ridout, Jr.


A. G. Hazen


F. C. Fenton


G. A. Karstens


R. C. Mueller


A. K. Simons


E. R. Cunningham


R. N. Roth

W. J. Ridout, Jr., general manager and editorial director, *Electricity-on-the-Farm* magazine, has accepted the position of agricultural development director for Carolina Power & Light Company's intensified agricultural development program in the two Carolinas, aimed at increasing farm income and encouraging greater use of electricity on the farm. He also will coordinate the company's present agricultural development work.

Arlon G. Hazen, dean, School of Agriculture, North Dakota State University of Agriculture and Applied Science, has been named acting vice-president in charge of the institution. He was appointed to this position due to the recent death of NDSU President Fred S. Hultz, and will serve in this capacity until a replacement for president has been selected.

F. C. Fenton, professor of agricultural engineering, Kansas State University, has been chosen to receive the Gamma Sigma Delta recognition for 1960 as an outstanding member of the KSU staff. He is a Life Fellow and a past-president of ASAE. Gamma Sigma Delta, the international honor society of agriculture, recognizes one outstanding alumnus of the K-State chapter and one outstanding member of the University staff each year.

Gerald A. Karstens, publication director, *Feed Age* Magazine, recently was promoted to vice-president of American Trade Publishing Co. He joined the firm in 1953 as director of engineering for *Feed Age* and in 1959 was named publication director, a post he will continue to hold. Prior to 1953, Mr. Karstens was a member of the staff of the agricultural engineering department of Purdue University for seven years.

Robert C. Mueller recently has been appointed to the position of executive secretary of the Sprinkler Irrigation Association. He has had 15 years' experience in the sprinkler irrigation industry. His first four years in the industry were spent as a distributor field engineer, establishing and training dealers in the Pacific northwest. During the Korean War he was on loan to the National Product Authority where he administered metal allocations to the irrigation and pump industries. Since returning from Washington to the sprinkler irrigation industry, he has worked in management capacities developing distribution throughout North America.

Allison K. Simons, director of research and engineering for Bostrom Corp., Milwaukee, Wis., has been named vice-president of Bostrom A. G., which is an international affiliate of the Bostrom Corp. Headquarters for Bostrom A. G. are in Switzerland and Mr. Simons will work in Europe full time. He has held management positions for eleven years with the firm.

Ernest R. Cunningham, formerly editor, *Design News,* is now engaged in consulting work on publications, house organs, and free lance technical writing. He was associated with *Design News* for six years, serving successively as western editor, chief field engineer, executive editor, and editor.

Robert N. Roth has accepted a position as sales engineer with the French & Hecht Division of Kelsey-Hayes Co., Davenport, Iowa. He previously had been associated with Goodyear Metal Products Division, Goodyear Tire and Rubber Co., in a similar capacity.

Dwight D. Smith, assistant director of water management, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, Beltsville, Md., recently received a Missouri Honor Award for Distinguished Service in Engineering. These awards were presented to five outstanding American engineers by the Engineering Foundation of the University of Missouri at the annual Engineering Convocation in Columbia, Mo.

Elmer E. Brown and **Leon J. Urben** recently have taken positions with the Farm Division of the National Safety Council. Mr. Brown has assumed the job of rural youth specialist, with the primary responsi-

NECROLOGY

John M. Larson, supervisor of rural cooperative sales for Northern States Power Co., died on March 15 at his home in Minneapolis, Minn., of a heart ailment. He was born December 24, 1899, in Bemidji, Minn. He specialized in architectural engineering at the University of Minnesota and later worked on the first experimental rural electric line in Red Wing, Minn., in 1923. He had been associated with Northern States Power Co. for 31 years in the capacity of sales engineer, as well as the position he held at the time of his death. He had been an ASAE member since 1938, and also held memberships in the Scottish Rite and the Shrine. He is survived by his wife, Florence; a daughter, Mrs. James McCarl; and a son, Richard.


J. M. Larson

Carl H. Neitzke, assistant farm safety director for the National Safety Council, suffered a fatal heart attack on April 4 at his home. He was born on May 8, 1910, in Larrabee, Wis., and received a B.S. degree in agricultural education from River Falls State Teachers College in 1931. He later received an M.S. degree from the University of Wisconsin. Before joining the staff of NSC, he was an extension specialist for 14 years with the University of Wisconsin, and for two years previously, a county agriculture agent. He has been a member of ASAE since 1946. He is survived by his wife, Eileen; two sons, Robert and Richard; and two daughters, Mary Gay and Jane Eileen.

Willard J. Durkee, retired Syracuse (N. Y.) branch manager for the J. I. Case Co., died in the Veterans Administration Hospital on January 26, after a short illness. He was born on January 12, 1897, at Belcher, N. Y. Mr. Durkee was in the service during World War I and had been associated with the Case Company for 40 years. Following retirement in 1953, he became an historical farm machinery enthusiast, and in 1959 was in charge of the historical farm machinery exhibit at the New York State Fair. At the time of his death he was in the process of writing a book about farm implements.

He had been a member of ASAE since 1939 and also held memberships in the Army Ordnance Association, Onondaga Historical Society, and the New York State Farm Equipment Dealers Association Inc. He also was a member of the advisory board of Alfred University, honorary and charter member of the New York State Steam Engine Association, and a past-president of the New York State Farm Equipment Club. Surviving are his wife, Mary Grace, and one daughter, Mrs. Paul (Marilyn) Britton.

bility of developing and carrying out youth programs in farm and home safety. He formerly was product specialist in the product research department of Deere and Co., Moline, Ill. Leon J. Urben has accepted the position of agricultural engineer. Previously, he was associated with the Tillage Implement Division of J. I. Case Co., Rockford, Ill., as a senior design engineer.

Kenneth A. Koch recently has been transferred in the Agricultural Extension Service of Louisiana State University from the position of associate agricultural engineer to rural sociologist.

Richard L. Wawrzyniak is now with the Indiana Flood Control and Water Resources Commission as an engineer. His duties consist mainly of working with the Small Watershed Program and Conservancy District in the state of Indiana. He was formerly employed by Farm Fans, Inc., in the capacity of agricultural engineer.

Donald C. Anderson, formerly with Ralston Purina Co., St. Louis, Mo., has accepted the position of systems engineer with Salina Manufacturing Co., Inc., of Salina, Kans.

Nickolas E. Westman is now associated with the firm of Braddock and Braddock, Minneapolis, Minn., in the practice of patent, trade mark, and copyright law. He formerly was a project engineer with Farmhand Co.

Roy Winkle, formerly agricultural engineer, Soil Conservation Service, USDA, is now Maumee River Basin engineer for the Division of Water, Ohio Department of Natural Resources.

Arnold K. Dimmitt has accepted a position with the International Voluntary Services at Saigon, Viet-Nam. He formerly was a student at Washington State University.

Merritt D. Hill, vice-president and general manager of the Tractor and Implement Division, Ford Motor Co., Birmingham, Mich., was one of five who recently received a "partner in 4-H" citation. The ceremony took place in the USDA Jefferson Auditorium, Washington, D.C., on April 28, the final day of the 31st National 4-H Conference. The citations were in the form of individually designed and framed certificates. Each recipient also received a token gift bearing the 4-H clover emblem.

Gad Hetsroni, a graduate assistant in the agricultural engineering department at Michigan State University, has been awarded the Albert T. Cordray International award by the East Lansing (Mich.) Lions Club. He is the first recipient of this award, which includes a $250 grant. It is designed to aid an outstanding foreign student each year, and named in honor of Albert T. Cordray, professor of communication skills at MSU, and formerly a counselor for foreign students. Mr. Hetsroni is a graduate student from Haifa, Israel, and is now working on his Ph.D. degree. He intends to return to Israel to do research and to teach.

James R. Adams, formerly fieldman for California Packing Corp., Mendota, Ill., has taken the position of test engineer with the Implement Test and Development Group, Farm Equipment Research and Engineering Center, International Harvester Co., Hinsdale, Ill.

Richard G. Bignall recently has accepted the position of assistant territory manager for the Lansing Branch House of John Deere Co. He previously was associated with the sales department of Motor Wheel Corp.

Richard M. Rion is a member of the National Retail Farm Equipment Association staff as service shop clinic instructor. He has the responsibility of preparing and conducting a one-day Service Shop Management Clinic for the benefit of the retail dealer members of the association. He previously was associated with Massey-Ferguson, Inc. as an assistant service manager.

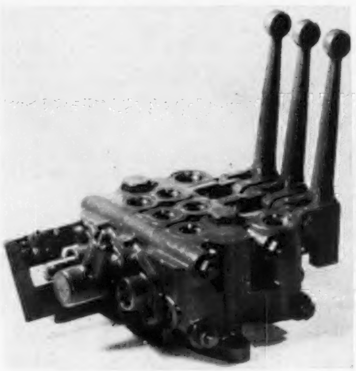
Charles W. Thomas advises that he is now located in Taipei, Taiwan, China, with the United Nations Special Fund Hydraulic Development Project of the Water Resources Planning Commission. He previously was head of the investigations section, Bureau of Reclamation, Denver, Colo.

David J. Holmes advises that he is now located in Taunggyi, Shan States, Burma, where he is the principle agricultural officer. The assignment involves advising and assisting the Government of the Union of Burma in the development of agricultural mechanization in the Shan States. He went to Burma from Australia, where he was a field test engineer in the engineering division of Massey-Ferguson (Australia), Ltd.

Warren A. Hall, associate professor in the engineering department at the University of California, has been named director of the University's statewide Water Resources Center.

Multiple Unit Valves for Mobile Equipment

Vickers Inc., Div. of Sperry Rand Corp., Detroit 32, Mich., has announced a new multiple unit hydraulic valve designed for



use on multiple operation mobile machinery such as materials handling and construction equipment. Designated as CM11 Series, the new valves are available in any number of sections up to 10, with individual load checks in each section. They are rated for operation up to 2500 psi. The valves are nominally rated at 15 gpm; however, higher flow rates are possible with pressure drops acceptable to the user. A new integral pilot operated relief valve is available with pressure settings from 500 to 2500 psi in increments of 250 psi. The new relief valve features extremely low pressure override characteristics.

Adds Hole Digger to Line

E. L. Caldwell & Sons, Inc., P.O. Box 2050, Corpus Christi, Tex., has announced production of a hole digger equipped with

a 9-in. auger, and designed to dig to a depth of 46 in. The new tool attaches to 3-point lift tractors and special hitches are also available. A rigid guide lever within easy reach of the tractor operator enables the user to dig a perpendicular hole, or one at an angle.

Chain Drives for Gas Turbines

Morse Chain Co., Ithaca, New York, has developed chain drives for transmitting power of gas turbine engines rated from 30 to 1800 hp. These chains are designed for main or auxiliary drives and for transmitting rotating power between parallel shafts at high speed. Designated Hy-Vo (high velocity-involute sprocket), the new chain uses compensating links for removing chordal action.

According to the manufacturer, the new chain also can be used for driving auxiliaries of two-shaft gas turbines. Typical auxiliary applications include powering: heat regenerators, lubrication oil pumps, fuel pumps, alternator or generator, cooling fan, governor, power takeoff, and starters.

4-Row Corn Head Attachment Announced

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has introduced a new 4-row corn head attachment for its Model C Gleaner-Baldwin combine. The down-front cylinder location permits use of the combine

feedhouse. Gear boxes and drive chains thereby are reduced to a minimum.

The combine has a 40-in. wide reversible rasp bar cylinder which is V-belt driven, a 48-in. rear separator, a 2-fan cleaning system, a grain bin holding 60 bu, and has a 13-ft long separating area.

Automatic Remote Controller for Kohler Engines

Kohler Co., Kohler, Wis., has developed a new and automatic remote controller, designed to start and stop engines according

to the power demand. The new controller is designed for use with all single-cylinder Kohler engines equipped with 12-volt combination starter-generator and automatic choke. Used with engines powering mobile air conditioners, refrigeration units, pumping systems, and the like, the controller starts and stops an engine automatically when actuated by a float switch, thermostat, time clock, or similar device.

When the engine begins to run under its own power, a cranking control relay disconnects the crank circuit. Should an engine fail to start, a switch trips automatically after approximately one minute and terminates cranking action until a reset button is pushed, thus preventing excessive drain on the battery. The controller may be used with either battery or magneto ignition.

New Tire Design

Goodyear Tire & Rubber Co., 1144 E. Market St., Akron, Ohio, has announced the development of double-tapered tread lugs for obtaining self-cleaning properties and traction in a new rice and cane tire design. Called the Special Sure Grip TD-7, the tire was developed for extremely muddy conditions in gumbo and sandy loam soils. The tire reportedly gains much of its accredited ability from the double angles in the lugs which lie diagonally toward the center of the open-face tread design. The space between the lugs gets progressively wider from the center toward the tire shoulder and with the change in the lug angle, straw, grass and mud are said to work outward from the center in a turbine-like flow.

Available for tractors and self-propelled combines, the tire is being manufactured in popular sizes ranging from 13.6-38 through 23.1-26.

Cutter Bit Power Pruner

McCulloch Corp., 6101 W. Century Blvd., Los Angeles 45, Calif., has introduced a new concept in pruning. The new tool fea-

tures a rotating cutter bit actuated by a shaft connected to a chain saw engine through a long aluminum pole. It enables the operator to reach limbs up to 16 ft or more from the ground. The cutter bit resembles a standard drilling bit, and turns at 6000 rpm, resulting in a "planing action" which is said to reduce bleeding, retard infestation, and encourage the tree to heal over the pruning cut quickly and smoothly.

MANUFACTURERS' LITERATURE

Literature listed below may be obtained by writing the manufacturer.

Grain Drier Literature

Aeroglide Corp., 510 Glenwood Ave., Raleigh, N. C. — The following two literature pieces are offered:

A 6-page, colorful bulletin describes and illustrates the Grain Bank Series of driers, including batch and continuous flow driers.

A booklet of grain storage-drying plants, entitled "Grain Industry Highest Profit Suggestions Package Plants — 18,000 to 81,000 Bushel Capacity," shows over-all space requirements in four plan views, and illustrates flow patterns with a pictorial representation of each layout. A listing and description of all equipment required to build the plant is included with each arrangement.

Evaporation Retardent

M. Michel and Co., Inc., 90 Broad St., New York 4, N. Y. — A 12-page booklet entitled "The Millionth of an Inch That Saves a Million Gallons of Water" describes Aqualoc NX, a product that reportedly saves water by cutting evaporation losses from open reservoirs.

Ditch and Pond Liner Engineering Bulletin

Watersaver Co., Inc., 3560 Wynkoop St., Denver 5, Colo. — A 16-page, 2-color bulletin describes and illustrates installations of the flexible ditch and pond liner. Included

in the installation instructions are those for ditch lining; repair of cracked or leaky rigid linings; repair of breaks in large canals; correction of piping large canals; lining reservoirs; lining farm ponds; water barrier in dams; relining leaky wooden flumes; and ground covers for water collection. Specifications are also included.

Two-Way Radio Guide

General Electric Co., Communication Products Department, Section P, P.O. Box 4197, Lynchburg, Va. — A 16-page nontechnical businessman's guide to two-way radio, entitled "Under the Influence of Radio" (No. ECR-568A), is a pocket-sized publication informing potential mobile communications users of some of the more important FCC licensing requirements. It discusses operational methods, such as how a message is sent, how to adjust a mobile radio, and record-keeping.

Industrial Lithography

The Electric Autolite Co., Industrial Lithography Division, Bay City, Mich. — A colorful, 4-page brochure describes the industrial lithography service and facilities of the company. Also included are descriptions and samples of panels, dials, escutcheons, and instruction plates done in a variety of available finishes, including special frost-etch method.

LP-Gas on the Farm Booklet

National LP-Gas Council, 1515 Chicago Ave., Evanston, Ill. — A 20-page, 4-color booklet entitled "LP-Gas on the Farm" includes information on installation and maintenance costs, as well as efficiency studies of LP-gas equipment on trucks, tractors, irrigation pumps, combines, balers, cotton pickers, and other farm machinery. It also describes and illustrates its more-recent applications, including pig farrowing, grain and nut drying, tobacco curing, dairy equipment sterilizing, poultry scalding, chick brooding, and orchard heating. Price, 25 cents.

Recording Fluorometer

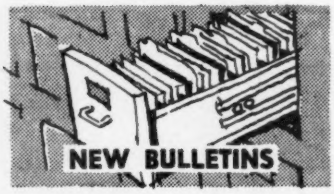
G. K. Turner Associates, 2524 Pulgas Ave., Palo Alto, Calif. — Data sheet describes and pictures Model 111 self-balancing fluorometer that provides both direct readout and outputs for various types of recorders or controllers. The model's optical-bridge design, its automated operation, and sensitivity of 0.02 ppb quinine sulfate are described. Specifications are also included.

Inspection Manual

American Zinc Institute, Inc., 292 Madison Ave., New York 17, N. Y. — A 34-page booklet entitled "Inspection Manual for Hot Dip Galvanized Products" describes the factors governing inspection, properties, specification, and purchasing of hot dip zinc coatings. Illustrated with photographs, charts, and graphs, it discusses such details as the metallurgical structure of zinc coatings, factors, influencing adherence, and the effects of various conditions of the basis metal.

Iron and Steel Graphic Facts Book

American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y. — The 1960 edition of "Charting Steel's Progress," a 64-page book, is the seventh based largely on the institute's annual statistical report. Covered in the book are materials used in steelmaking; iron and steel growth in capacity; progress in steel production; markets for finished steel; foreign trade in steel; wages, hours and working conditions in steel; and finance — steel's income and outgo. Price, 50 cents.



The following bulletins have been released recently. Copies may be obtained by writing to author or institution listed with each.

The following 5 bulletins are available from the Canada Department of Agriculture, Ottawa, Ontario, Canada:

A Small Barley De-Awner, by J. G. Kemp, A. E. Hannah and W. Kalbfleisch. Reprinted from Canadian Journal of Plant Science 39:241-245, April 1959.

A Photoelectric Device for Measurement of Leaf Areas, by L. S. Donovan, A. I. Magee, and W. Kalbfleisch. Reprinted from Canadian Journal of Plant Science 38:490-494, October 1958.

Note on an Apparatus for Controlling Soil Temperatures. Reprinted from Canadian Journal of Soil Science 40:105-107, February 1960.

Studies on the Application of Infrared in Food Processing, by E. A. Asselbergs, W. P. Mohr, and J. G. Kemp. Reprinted from Food Technology, 1960, Vol. XIV, No. 9, Pages 449-453.

Progress Report — 1954-1958, Horticulture Division, Central Experimental Farm, Ottawa, Canada. Experimental Farms Service, Canada Department of Agriculture, Ottawa, Ontario, Canada.

Proceedings of the Third Japan Congress on Testing Materials. 1960. The Japan Society for Testing Materials, Kyoto, Japan.

The following 4 bulletins are available from Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N. Y.:

Farm Implements for Arid and Tropical Regions. FAO Agricultural Development Paper No. 67. 1960.

Methods and Machines for Tile and Other Tube Drainage. Farm Power and Machinery Informal Working Bulletin 6.

Planning and Organization of Projects for the Improvement of Hand and Animal Operated Implements. Farm Implements Informal Working Bulletin 12 (Revised).

Safety Measures for the Use of Agricultural Machinery. Farm Power and Machinery Informal Working Bulletin 14.

The three following plan sheets are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. Price, 5 cents each.

Plan No. 5869 — A Drying and Storage Shed. USDA Miscellaneous Publication No. 835. March 1961.

Plan No. 5878 — Pole Corn Crib. USDA Miscellaneous Publication No. 839. April 1961.

Plan No. 7132 — 3-Bedroom Farmhouse . . . with attached two-car garage. USDA Miscellaneous Publication No. 842. March 1961.

Water and Irrigation. Agricultural Committee, The American Bankers Association, 12 E. 36th St., New York 16, N. Y.

Symposium on Poultry Health. March 1961. Agricultural Engineering Dept., University of Georgia, Athens.

North Central Regional Extension Publication No. 11, The Farm Corporation. Pamphlet 273. June 1960. Cooperative Extension Service, Iowa State University, Ames.

Get Full Farm Power and Farm Better Electrically. Northern States Power Co., 15 S. Fifth St., Minneapolis, Minn.

Publications of the Illinois State Water Survey. January 1961. State Water Survey, Box 232, Urbana, Ill.

The following two reprints are available from Michigan State University, East Lansing, Mich.:

Survey of Homogenized Milk in Michigan — I. The Extent, Operating Conditions, and Utilization of Returns, by G. M. Trout, Carl W. Hall, and A. L. Rippen. Article 43-67. February 1961. Reprinted from the *Quarterly Bulletin* of the Michigan Agricultural Experiment Station, MSU, East Lansing. Vol. 43, No. 3, pages 618-633, February 1961.

Survey of Homogenized Milk in Michigan — II. Functions, Maintenance, and Care of the Homogenizer with Suggested Sequences of Operation, by Carl W. Hall, G. M. Trout, and A. L. Rippen. Article 43-68. February 1961. Reprinted from the *Quarterly Bulletin* of the Michigan Agricultural Experiment Station, MSU, East Lansing. Vol. 43, No. 3, pages 634-647, February 1961.

Determination of Member Stresses in Wood Trusses with Rigid Joints, by Stanley K. Suddarth. Research Bulletin No. 714. February 1961. Agricultural Experiment Station, Purdue University, Lafayette, Ind.

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Aultman, James V. — Residential sales engr., Georgia Power Co. (Mail) R.R. 2, Tifton, Ga.

Baum, Russell O. — Farm owner and operator. (Mail) Box 7, Ashton, Ida.

Bice, Winston O. — Farm rep., Standard Oil Co. (Mail) Box 485, Auburn, Ala.

Branton, Donald L. — Rural elecn. advisor, Wisconsin Public Service Corp., 600 N. Adams St., Green Bay, Wis.

Brewer, Harold L. — Res. asst., agr. eng. dept., University of California. (Mail) 716 E. Eighth St., Davis, Calif.

Briggs, William B. — Chief engr., Norris Grain Co., Room 1640 Board of Trade Bldg., Chicago 4, Ill.

Cappe, George A. — Dir. of safety and eng., Florida Farm Bureau, 4350 S.W. 13th St., Gainesville, Fla.

Cress, John F. — Vice-pres. and sales mgr., Buchanan Steel Products Corp., Buchanan, Mich.

Dahlberg, Robert W. — Engr., Pioneer Hi-Bred Corn Co., Johnston, Iowa

Enz, Richard W. — Irrigation spec. and snow survey supervisor, (SCS) USDA. (Mail) 105 E. Cairo Dr., Tempe, Ariz.

Fairbairn, Robert C. — Equip. spec., Illinois Farm Supply Co., Bloomington, Ill.

Fogler, Thomas K. — Admin. engr., Pratt and Whitney Aircraft Co. (Mail) 916 East St., S., Suffield, Conn.

Freseman, Ray C. — Asst. to the managing dir., American Concrete Pipe Assn. (Mail) 1932 N. Lincoln, Chicago 14, Ill.

Gibson, Turner — Mgr., farm equipment retail store. (Mail) P.O. Box 424, Tifton, Ga.

Gray, J. H. — Pres., Tupelo Spindle Co. (Mail) Box 280, Tupelo, Miss.

Hedman, Clarence L. — Chief engr., agr. res. div., Shell Development Co., P.O. Box 3011, Modesto, Calif.

Iverson, Roger N. — Field serv. engr., John Deere Co. (Mail) Harrisburg, S. D.

Jessop, Guy S. — Eng. proj. mgr., Gordon Edgell & Sons Ltd. (Mail) 25 Keswick St., Cowra 3W, N.S.W., Australia

Jewett, Raymond L. — Exec. vice-pres., Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

Kureishy, Mashhood A. — Res. officer, Planning Commission, Government of Pakistan. (Mail) P.O. Box 394, Davis, Calif.

Leviticus, Louis I. — Graduate res. asst., agr. eng. dept., Technion-Israel Institute of Technology. (Mail) 3 Ruth Hacohen Ave., Nevei Shaanan, Haifa

Linseisen, Frank J. — (With U.S. Air Force) 6593D Test Squadron, APO 953, San Francisco, Calif.

May, Patrick L. — Prod. engr., International Harvester Co. (Mail) 2671 Skylake Dr., Memphis, Tenn.

(Continued on page 267)

. . . Membership Applicants

(Continued from page 265)

Miller, Carol H. — Hydraulic engr., U.S. Bureau of Reclamation. (Mail) 2240 Brighton, Oklahoma City 20, Okla.

Perera, John M. G. — Serv. mgr., agr. div., Brown & Co., Ltd., P.O. Box 200, Darley Rd., Colombo, Ceylon

Peterson, Gustav E. — Dist. engr., Prairie Farm Rehabilitation Administration, Canada Dept. of Agr. (Mail) Box 155, Gravelbourg, Sask., Canada

Ricketts, Charles J. — Proj. engr., Sundstrand Aviation Div. (Mail) 1516 Chelsea Ave., Rockford, Ill.

Rudolph, Henry G., Jr. — Staff engr., products dept., Socony Mobil Oil Co., Inc., 150 E. 42nd St., New York, N. Y.

Selby, Walter E. — Ext. agr. engr., eng. ext. dept., Kansas State University. (Mail) 1025 College Ave., Manhattan, Kans.

TRANSFER OF MEMBERSHIP

Balsillie, Ian M. — Instr. and ext. spec., Kemptville Agricultural School. (Mail) Box 482, Kemptville, Ont., Canada (Affiliate to Member)

Buchta, H. Glen — Area engr., (SCS) USDA. (Mail) 815 W. J. St., McCook, Nebr. (Associate Member to Member)

Henson, Clarence E., Jr. — Asst. chief product engr., J. I. Case Co., Rockford, Ill.

Norum, Edward M., Jr. — Proj. engr., Experiment Station, Hawaiian Sugar Planters Assn., 1527 Keeaumoku St., Honolulu, Hawaii (Associate Member to Member)

Swamy Rao, A. A. — Res. engr., John Deere Intercontinental, S.A. (Mail) 24, Shankar, Mahal, off Warden Rd., Bombay 26, India (Associate Member to Member)

STUDENT MEMBER TRANSFERS

Arends, Erwin O. — (University of Illinois) Mississippi Valley Structural Steel Co., 1020 W. Main St., Decatur, Ill.

Barquest, Glenn D. — (University of Wisconsin) 1618 Hubbard Ave., Middleton, Wis.

Bender, Joseph M. — (Michigan State University) 117 North St., Chardon, Ohio

Bishop, Marvin L. — (University of Nebraska) With U.S. armed services. (Mail) 117 W. Davis Ave., Harlingen 1, Tex.

Borghoff, William R. — (University of Missouri) With U.S. armed forces. (Mail) 2214 Hattan Lane, Brentwood 17, Mo.

Carlson, George H. — (University of Minnesota) 3518 Polk St., N.E., Minneapolis 18, Minn.

Castle, Richard — (Oklahoma State University) Jet, Okla.

Hightower, Sid C. — (Auburn University) Route 1, Box 55, Clayton, Ala.

Hurlburt, Joseph C. — (Pennsylvania State University) Eng. dept., New Holland Machine Co., New Holland, Pa.

Marshall, Dale E. — (Michigan State University) R.R. 1, Gregory, Mich.

Martin, Kenneth R. — (Oklahoma State University) Cherokee, Okla.

Nelson, David V. — (University of Minnesota) Pelican Rapids, Minn.

Pope, James D. — (Oklahoma State University) Loyal, Okla.

Remmers, Harry E. — (University of Illinois) Agr. eng. dept., Univ. of California, Davis, Calif.

Simons, Myron D. — (Oklahoma State University) Medford, Okla.

PERSONNEL SERVICE BULLETIN

Note: In this bulletin the following listings current and previously reported are not repeated in detail. For further information, see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this bulletin, request form for Personnel Service listing.

Positions Open – (1960) **November** – O-392-647, 393-648. **December**–O-407-649. (1961) **January**–O-434-654, 440-655, 461-656, 465-657, 465-658. **February**–O-11-101, 13-102, 10-103, 35-104. **March**–O-67-107, 76-108, 77-109, 71-112, 71-113. **April**–O-103-114, 129-115, 129-116, 95-117, 115-118, 163-119.

Positions Wanted – (1960) **November**–W-338-80, 377-81, 379-83, 365-84, 376-86, 355-87, 394-88. **December**–W-420-89, 419-90. (1961) **January**–W-431-94, 444-95, 453-96. **February**–W-8-1, 21-2, 22-3, 29-5, 16-6, 30-7, 34-8. **March**–W-66-9, 58-11, 56-12, 75-14, 96-15. **April**–W-121-16, 112-17, 135-18, 142-19, 115-20, 160-21, 161-22, 162-23, 164-24, 166-26, 171-27, 178-28.

NEW POSITIONS OPEN

Agricultural Engineer (product supervisor) for basic product design, application engineering, and technical evaluation of non-standard product inquiries relating to farm building products, with major manufacturer of metal building materials. East. Age 30-40. BSAE preferred. BSME or BSCE acceptable. Must know farm structures from design and product application standpoints. Technical interest and sales orientation required to properly represent company at technical society and other meetings. Opportunity for advancement in product development, marketing, or field sales organization. Salary $650-$800 per month. O-189-120

Agricultural Engineer for project engineering in hydraulic and mechanical design of self-priming and/or straight centrifugal pumps, with established manufacturer. Midwest. Age in range from a few years experience to several years before retirement. Engineering degree and some experience in pump design, or equivalent. Opportunity for advancement with growing company in domestic, farm, and industrial pump fields. Salary open. O-198-121

Agricultural Engineers (research fellowships) for work in any areas of agricultural engineering or food engineering, according to interest. BS degree in any field of engineering or agricultural science. Opportunity for one-half time work toward MS degree. Young, well qualified staff and excellent facilities. Salary $2400. O-199-122

Agricultural Engineer (assistant or associate professor) for teaching and research in soil and water field, in a southern state university. Age 30-45, or younger if PhD. MSAE required. Prefer PhD completed or in progress. Able to work with students, other staff members, and farmers. Able to recognize research problems. Farm background. Teaching and research experience in soil and water field desirable. Excellent opportunity for advancement for able man. Fringe benefits include life and health insurance and vacation with pay. Salary open. Position to be filled by July 1 if possible. O-212-123

Agricultural Engineers (graduate research assistants) for research in vegetable crop harvesting, conveyance of chopped forage, environmental control for tobacco curing, or broiler production, with graduate study leading to MS degree. BSAE or equivalent, with academic average acceptable to graduate school. Interest in research and desire to do graduate work. Graduate study rate 10 semester hours (12 under GI Bill). MS requirements 30 semester hours, including course work and thesis. Research work assignments usually applicable to thesis subject. Applications acceptable throughout year. Stipend $2000 for 10 months or $2400 for 12 months plus remission of tuition ($120 per semester) and non-residents fee ($150 per semester). O-218-124

Agricultural Engineer to design livestock feeders and waterers, and all types of feed-handling systems for medium-sized midwest corporation. Will be in charge of designing equipment for new automatic division. BSAE. Farm background preferred. Excellent opportunity for advancement with one of the largest manufacturers in its field. Salary open, depending on experience. O-226-125

NEW POSITIONS WANTED

Agricultural Engineer for design, development, research, extension, or teaching in electric power and processing field, with industry or public service in Upper Midwest, West, or Alaska. Willing to travel. Married. Age 28. No disability. BSAE 1955, Purdue University. MSAE expected June 1961, University of Minnesota. Some farm work experience. Summer employment in research engineering department of farm equipment manufacturer. Experience as research assistant in four university agricultural engineering departments. Teaching experience in Army and at University of Minnesota. Military Service in Army 2 years. Available July 1. Salary $6000. W-187-29

Agricultural Engineer for development, teaching, or research in farm structures with industry or public service, preferably in Canada. Single. Age 25. No disability. BSAE. MSAE expected September 1961, both at University of Saskatchewan. Summer work experience in surveying for irrigation, mining, and in farm equipment business. Available Sept. 15, 1961. Salary $475-525 per month. W-190-30

Agricultural Engineer for design, development, or research in power and machinery with manufacturer. Any location in USA except Southeast. Married. Age 30. Vision corrected. BSAE 1952. Design experience 5 years with both short line and full line manufacturers. Available on reasonable notice. W-97-31

Agricultural Graduate for development, sales, service or management. Any location. Prefer northern U. S. Limited travel. Married. No disability. BSA expected June 1961, Emmanuel Missionary College. Minors in biology and chemistry. Training in farm and soil management. Actual farm management experience 8 years. Additional work experience with college field crops and dairy departments. Available June 5. Salary $5,200+. W-200-32

Agricultural Engineer for sales, service, or writing in power and machinery or product processing with industry. USA or Canada. Single. Age 21. Vision corrected. BSAE expected June 1961. University of Maine. Summer work experience as field test engineer trainee with farm equipment manufacturer, and with university as research assistant. Available June 26. Salary open. W-201-33

Agricultural Engineer for design and development in power and machinery with manufacturer. Eastern U.S. or Canada preferred. Single. Age 22. No disability. BSAE expected June 1961, University of Maine. Summer work experience in crop and livestock farming, as dairy route salesman, and electrician for paper manufacturer. Available July 1961. Salary open. W-202-34 *(Continued on page 270)*

CHECK POINTS

by J. L. BUTT

WHERE CREDIT IS DUE —

Occasionally, members or groups of members render services on behalf of their professional organization which deserve special attention. One such project has recently been completed that we feel all members should know about.

Etlar Henningsen, Senior Project Engineer of the John Deere Spreader Works, started the whole thing when he was serving as Membership Vice-Chairman of the Power and Machinery Division last year. He contacted each agricultural engineering department throughout the United States and Canada and obtained lists of their graduates. With assistance from other members at the John Deere Spreader Works, the task of checking the list of graduates against the ASAE membership roster was begun and around 1000 letters were sent to these graduates who were not ASAE members. But there were 2691 *additional* names on the list!

At this point, Robert G. Morgan of Timken Roller Bearing Company, as Chairman of the Quad City Section, offered to complete the project as a section activity. Ray Wilkes, John Deere Spreader Works, agreed to accept the responsibility of organizing and coordinating the work, and the following members (*and* their wives) agreed to assist: B. J. Carpenter, International Harvester Company; J. L. Corkery, John Deere Harvester Works; Robert Johnson, J. I. Case Company; Dwight Nelson, John Deere Industrial Equipment Works; C. B. Peak, John Deere Harvester Works; John Strever, J. I. Case Company; and P. G. Togami, International Harvester Company. This group sorted through the remaining list of college graduates, screened them against the ASAE yearbook, and addressed envelopes to those who were not ASAE members.

Stuffing several enclosures into this number of envelopes was done by Ray and Mrs. Wilkes (try it sometime to get an idea how much work is involved). Ray then obtained the cooperation of several ASAE members at the John Deere Spreader Works in licking the 2691 stamps (it's rumored that they strongly advocate the use of flavored glue on postage stamps).

A certain percentage of the letters failed to reach their mark because of out-of-date addresses (after all, many dated back to the pre-World War II era), but the over-all impact and effectiveness of this membership effort is very significant. Quite a few former members have reinstated membership (it is impossible to tell *exactly* how many were directly related to this effort, but the current rate of renewals is much higher than normal). To date, 39 applications have been received at ASAE headquarters positively identified with this activity. And who can measure the value of the contacts established and the interest shown in former graduates that will bear fruit for months and years to come?

This is another example of the enthusiastic professional dedication which has become the symbol of the agricultural engineer. And it's a case in point illustrating the reason why agricultural engineering as a profession, and the American Society of Agricultural Engineers, are entering a new era of growth, professional strength, value to members, and service to agriculture.

* * *

Active Sections Contribute to Progress

We just received a letter from T. N. Jones, Mississippi State University (Secretary-Treasurer of our new Mississippi Section), which read in part as follows: "This (enclosed) application will give us 100% increase in membership in Mississippi since we started last Spring."

This gives further evidence of the value of state and local sections in building membership. More significantly, it represents a strengthening of professional development on a local level; growing unity among agricultural engineers in diverse but interrelated areas of activity; a better opportunity to cooperate effectively in advancing the objectives of agricultural engineering.

The new section will provide a forum for agricultural engineers in different fields of work to compare notes, present programs for friendly, constructive critique, join together to promote those developments and practices which will contribute to a better agriculture. Young engineers will have a better chance to develop into informed, well-rounded leaders through association with more experienced engineers. Agricultural engineering technology will experience an over-all boost as a result of the increased opportunity to gain new insights and viewpoints; to understand the broader aspects of agricultural engineering, rather than just one's own specialty; to exchange information and experiences; and to give publicity and recognition to progress and achievement in the field of agricultural engineering.

There are other geographical areas in which state or local sections would have similar opportunities to serve agriculture and the members of our profession. Take a look around you if you are not already served by a section — could your area benefit from an active professional and technical program of agricultural engineering activities? ASAE welcomes the opportunity to help in establishing new sections — and the "red tape" is kept to an absolute minimum.

Meantime, our hats are off to all the T. N. Joneses who have demonstrated leadership, rolled up their sleeves, and set in motion local and state professional groups to elevate the stature of agricultural engineering in their areas. Their records of professional dedication and action form the foundation stones of agricultural engineering progress.

. . . Personnel Service

(Continued from page 268)

Agricultural Engineer for design, development or research in soil and water field, especially concrete ditches and pipe. Any location. Married. Age 30. No disability. BSA, Arizona State University expected May 1961. Two years training in civil engineering. Experience in surveying, equipment operation, land preparation, and field engineering for irrigation ditch lining and continuous pipe contractor. Military service in USMC 3 years as engineer equipment operator and construction surveyor. Available June 1961. Salary open. W-203-35

Agricultural Engineer for design and development in power and machinery or product processing fields with manufacturer or processor, anywhere in USA. Single. Age 22. No disability. BSAE expected June 1961, University of Maine. Farm background. Available June 15, 1961. Salary open. W-204-36

Index to Advertisers

ADVERTISING REPRESENTATIVES

NEW YORK 17 —
BILLINGSLEA AND FICKE, 420 Lexington Ave. LExington 2-3667

CHICAGO 1 —
DWIGHT EARLY AND SONS, 221 N. La Salle St. CEntral 6-2184

SAN FRANCISCO 5 —
McDONALD-THOMPSON, 625 Market St. EXbrook 7-5377

LOS ANGELES 5 —
McDONALD-THOMPSON, 3727 W. Sixth St. DUnkirk 7-5391

SEATTLE 4 —
McDONALD-THOMPSON, 1008 Western Ave. MA. 3-3766

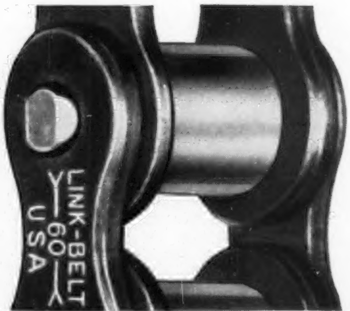
PORTLAND 1 —
McDONALD-THOMPSON, 2035 S.W. 58th Avenue. CApital 2-5146

DENVER 3 —
McDONALD-THOMPSON, 620 Sherman St. TAbor 5-3325

HOUSTON 6 —
McDONALD-THOMPSON, 3217 Montrose Blvd. JA. 9-6711

DALLAS 19 —
McDONALD-THOMPSON, 2727 Oak Lawn Ave. LAkeside 7-1324

Advertising Manager:
HARMON MULBAR, 420 Main Street, St. Joseph, Mich. YUkon 3-2700



LINK-BELT drive and conveyor chains

travel with the leaders

MASSEY-FERGUSON NO. 10 HAY BALER employs Link-Belt precision steel roller chain and double pitch AG roller chain for positive driving. High ultimate strength of these chains withstands heavy loads . . . assures long service life.

Over 300 quality-conscious farm machine manufacturers rely on Link-Belt for chain . . . and bonus services besides

If you want chain that's the efficiency-equal of your equipment, join the more than 300 leading manufacturers who go with Link-Belt. Experience has shown them that the refinements built into Link-Belt chain make a vast difference in field performance, help assure customer satisfaction for their machines.

Standard-pitch Link-Belt roller chain, shown at left, is a popular choice for transmitting power on such equipment as hay balers. It features high hp capacity and light weight . . . has consistent quality and uniformity in every link.

Link-Belt offers industry's most complete line of drive and conveyor chains, conveyor chain attachments and sprockets. Also, "bonus" services: application counsel, field analysis, laboratory service and others. These services multiply the *value* of Link-Belt chains, *but not the price!* Contact your nearest Link-Belt office or the Indianapolis plant at 220 S. Belmont Ave. Ask for 640-page Catalog 1050.

IMPORTANT! Link-Belt roller chains for the agricultural field are *true* roller chains. They have *free-turning* rollers. Hence, longer life for chain and sprocket because there's no scrubbing or sliding over sprocket teeth.

LINK-BELT

15,632

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses, District Sales Offices and Stock Carrying Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World.